the science of beauty

Vol 12 No5

June / July 2023

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NEW ZEALAND SOCIETY OF COSMETIC CHEMISTS

Embrace the Elements at this year's **NZSCC 43rd Annual Conference!**

Join us for an extraordinary experience at the 43rd Annual New Zealand Society of Cosmetic Chemist conference, taking place in the breathtaking city of Napier from 2nd to 4th August 2023. This highly anticipated event promises to be a highlight on the calendar for cosmetic chemists, industry professionals, and enthusiasts alike.

Under the theme of "Embrace the Elements," this conference will offer a dynamic platform for knowledge exchange, networking, and inspiration. Engage with leading experts in the cosmetic science field, who will share cutting-edge research, advancements in formulations, and insights into the latest trends and technologies.

"We're excited to have crafted an action-packed two-and-a-half-day technical programme, with over 25 presenters, several panel discussions, workshops and leading keynote speakers," said President, Eve Storer-Blake. "Our Kiwi hospitality shines, and each year we build on a solid foundation of warmth, friendship and collegiality that our cosmetic networking events are renown for, we can't wait to welcome members from the ASCC and beyond to join us in August."

Napier, known for its stunning art deco architecture and picturesque landscapes, provides an idyllic setting for this prestigious event. Immerse yourself in a vibrant atmosphere, surrounded by like-minded professionals, as you explore the latest breakthroughs in cosmetic science.

Don't miss this unparalleled opportunity to enhance your expertise, expand your network, and contribute to the advancement of the cosmetic industry. Mark your calendar and register today for the 43rd Annual New Zealand Society of Cosmetic Chemist conference in Napier. We look forward embracing the elements with you at this transformative event!

Date: 2nd-4th August 2023
Where: Napier War Memorial Conference Centre, 48 Marine Parade, Napier, New Zealand

To register and for more information visit our website nzscc.org.nz and follow our LinkedIn page for updates.

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meet the team...

WENDY FREE has degrees in Science (B.Sc) and Technology Management (M.Tech Mngt) and is a member of a number of industry associations including Australian Society of Microbiologists, Royal Australian Chemical Institute, Association of Therapeutic Goods Consultants and is a Fellow of the Australian Organisation for Quality. With more than 25 years industry experience, Wendy's current roles include APVMA GMP auditioning, contributing to the Cochrane Collaboration and on a day to day basis, Scientific Director Quality Matters Safety Matters Pty Ltd (QMSM) that has over the last decade Wendy has provided expertise to over 400 Australian and International businesses. She specialises in regulatory compliance, commercialisation, troubleshooting and GMP systems, and considers cosmetics amongst the most challenging and enjoyable part of her work.

JULIAN JONES, the founder and Managing Director of ikonsulting Pty/Ltd, is Passionate about the Personal Care Industry in Australia and Globally.
Julian has been an active member of the ASCC for over thirty years. During this time he has served as President and Chairman of the Victorian Chapter of the ASCC. He is widely known and well respected both nationally and internationally for his knowledge and skills in developing and marketing the best Personal Care Products.

JOHN STATON has a background of over 40 years experience in the pharmaceutical and healthcare industries. John is a life member of the ASCC and serves in a number of industry representative roles with ASMI, ACCORD, TGA and Standards. He is the Australian representative to the ISO Committee on Sunscreen Testing-TC 217. (The committee for development of sunscreen standards). John is also in demand as a speaker on the International Conference Circuit.

MICHELLE KANE is the managing director of PharmaScope Pty Ltd, a privately owned contract manufacturer established in 2004. Michelle has over 30 years experience in the pharmaceutical and personal care industry, being involved at many levels from procurement, product development, manufacturing, financial management and staff training and development, to name a few... Being based on the West Coast always brings the added challenge of seeking niche product development solutions and working creatively to achieve manufacturing outcomes in a competitive marketplace for our clients global demands.

PAM JONES has worked in the Personal, Homecare and Pharmaceutical markets for more than 30 years. She has been working out of Asia since 1996 and is well versed and connected with the Asia Market.
Her experience covers technical, sales, marketing, management and training roles. She has qualifications in Chemistry, Marketing and Management. Her company PCA Consulting is well known for its training programmes. Pam has worked with and consulted to companies such as ICI, Croda, Ashland, Huntsman, Reed Exhibitions (in Cosmetics) and Connell to name a few. She is currently serving on the ASCC Technical Committee and volunteers as Technical Editor for this magazine.

NICHOLAS URQUHART gained a degree in Applied Science at RMIT and has been involved in the personal care industry for over 40 years, the majority of which has been spent in product development. He has worked across numerous sectors - aerosols, fragrances and all aspects of cosmetic and household formulation and operated as a private consultant for the last 12 years or so. Nick has served on the ASCC Technical committee since 1996 and represented the society on various committees at both the TGA and Standards Australia. He chaired the IFSCC 2009 Conference Steering Committee at the Melbourne conference. He was a founding member of Monash University's 'Bachelor of Pharmaceutical Science' Industry Advisory Group and previously presented the 'Cosmetic formulation' module to the third year of that course.

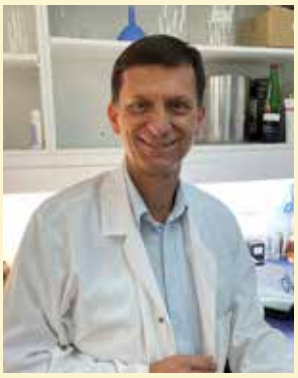
JEN SEMPLE is Innovation & Education Manager at Accord Australasia, the peak national body for formulated chemical products. She is passionate about communicating the benefits of our industry's products to wider society and has authored a number of public education websites such as furphies.org.au, sunsible.org.au and hygieneforhealth.org.au. Jen also manages Accord's sustainability initiatives and seeks opportunities to build relationships between industry and academia. She has a PhD in Chemistry and Graduate Diploma in Education, and is a member of the Royal Australian Chemical Institute.

STEVE WELSH is a cosmetic packaging specialist with over 20 years experience across all mediums of packaging. As the director of Weltrade Packaging, Steve leads a team of designers, technicians, printers and supply chain professionals. To ensure the best exposure of your beauty, skincare or cosmetics brand. Steve's philosophy is to design your packaging correctly, right from the start, so you can elevate your brand and move more product. Steve works closely with leaders in the cosmetic industry to ensure that your packaging consistently stands out on the shelves within this highly competitive market.

EMANUELA ELIA is the Director of Ozderm, which specialises in *in vivo* testing and clinical trials for cosmetic and personal care products. Emanuela Elia has a law degree from Rome and a Master of International Business from the University of Sydney. She had collaborated with Australia's longest serving Contract Research Organisation Datapharm for a few years before setting up a cosmetic and personal care products testing facility in 2009. Emanuela is enthusiastic about improving the quality of cosmetic and personal care products' research in Australia through science.

JAMES GILLARD is the Principal of Insurance Made Easy whose services include – business insurance, travel insurance and financial services. Insurance Made Easy has a client list of over 2000 businesses from all industries. The relevant major insurance schemes are – Hair and Beauty, Pharmaceutical Companies and Natural Therapists.

MARG SMITH is the owner of Syndet Works – an Australian company established in 1984 to formulate and produce soap free skincare bars. Syndet has developed an enviable reputation for custom formulated and manufactured skincare that now extend well beyond the origins of the business.



GEORGE ORBAN has been the Formulation Development Manager at Eurofins Dermatest (formerly Technical Consultancy Services) since March 1999. Eurofins Dermatest is the only laboratory in Australia that conducts in-vivo sunscreen testing. George has been involved with the formulation of various cosmetic, veterinary and therapeutic products. In particular, George specialises in sunscreen formulation. In his role, he has become familiar with various in-vitro and in-vivo testing methods as well as regulatory aspects of sunscreen formulation.Early in his career, George spent five years at SC Johnson, then another five at Reckitt Benckiser (formerly Samuel Taylor) being involved in the formulation of various household and personal care products. He was also Technical Manager at two contract aerosol manufacturers – Aeropack Australia and CP Technologies - prior to joining Dermatest. George has a degree in Industrial Chemistry from UNSW. He has been a member of the ASCC since 1994 and has recently joined the ASCC's Technical Committee

ARMELLE SEBBAG has a Master's degree in Cosmetic Formulation from ISIPCA Versailles in France. She worked as a cosmetic formulator in France, the US, the UK and Australia since 2011. She joined Avenir Ingredients in 2017 to look after the Victorian business. Her experience includes skincare, haircare, body care and colour cosmetics. Armelle is also interested in wellness and holds a diploma of Shiatsu and Oriental Therapies.

CATHERINE CERVASIO has experience in natural and organic personal care, marketing, baby skincare and product development spanning 25 years. Catherine is the Founder of Aromababy- a pioneering baby skincare brand launched in 1994, which combines the use of natural and organic ingredients with research. She is a regular speaker, presenter and contributor to several online and print publications.

PROTEIN SUPPLEMENT PACKAGING

As a packaging professional with 30 years of experience working with plastics, glass, and cardboard for cosmetics, FMCG, and Pharma, I am still surprised by the lack of understanding and misinformation surrounding packaging, especially its impact on the environment. The primary purpose of packaging is to safely and efficiently deliver the brand's product to the consumer. However, these days, brands should also consider the environmental impact of their packaging, both now and in the future. By doing so, they demonstrate good corporate citizenship, which resonates well with consumers.

In this article, let's focus on protein and supplement packaging, a market that traditionally hasn't been overly concerned about the environmental repercussions of packaging. While functionality and aesthetics are important, the environmental impact has been largely neglected.

Plastic pails: There used to be a significant amount of bulk products sold in pails. However, these containers have a high material-to-product ratio, do not ship well when filled, and are heavy to carry home. While technically recyclable, they present challenges due to their excessive carbon footprint

by Steve Welsh

and contribute to landfill problems. Wide-mouth jars, which are still widely used for packaging products, can be made from PET and HDPE. PET has a recycling code of 1, and HDPE has a code of 2 (refer to the recycle codes here). These jars are lighter than pails, resulting in a lower carbon footprint, and are easier to recycle. However, if they are disposed of in general waste, they can persist for multiple generations.

Stand-up pouches: This is a relatively newer type of packaging, often referred to as a zip-lock bag, which is popular among brands due to its excellent shipping capabilities and decorative options. Recent news about the collapse of Redcycle highlighted that these soft plastics are NOT recyclable. Each pouch, although small, is made from a laminate or combination of plastics and will end up in rubbish or landfills for multiple generations.

Composite cans: Another type of packaging that has gained popularity is composite cans. Consumers often perceive the cardboard exterior as environmentally friendly, but this is not entirely accurate. This type of packaging is highly wasteful as many cans are lost due to denting. They are made of cardboard and have a layer, sometimes plastic and sometimes foil, to maintain product freshness. As a result, they are NOT recyclable, and the energy required to produce this type of packaging makes them highly carbon-inefficient. While some components of the laminate will break down in landfill, others will persist for multiple generations.

The best practice, considering today's technology, is to use a wide-mouth jar with as much food-safe recycled content as the brand can afford, which is also biodegradable in landfill. Why? This type of packaging is well-suited for transportation, maintains product flavour and shelf life, and is made from recycled materials—essentially giving a "second life" to materials from other packaging, such as juice or water bottles. It is also recyclable, as indicated by the recycling codes mentioned earlier, and biodegradable in landfill. This means that if the packaging is not recycled or if there is an excess of recyclable material, it will degrade naturally without leaving behind microplastics.

We have witnessed the adoption of sustainable packaging in skincare and food packaging. At Weltrade Packaging, we are leaders in responsible and sustainable packaging. We understand that packaging must first fulfil its primary purpose and then strive to be as sustainable as possible. We are proud to be a member of the Australian Packaging Covenant, and our HACCP and ISO approvals further attest to our commitment to quality and sustainability. We are passionate about your brand and the environment we live in. Let's address these issues today instead of pushing them to become tomorrow's problems.

You look great ...for your Age!

by Julian Jones, Ikonique

In 2020, the median age of Australians was 36.7 years. It is projected that the median age in 2050 will be 43.6 years and by 2100, 47.9 years. And think about this – many of the people alive today (including those reading this article) may still be alive in 2100!

Obviously, there are a number of assumptions in these projections and major changes in birth rates, immigration and medical emergencies could impact their accuracy – but let's accept that these projections are relatively accurate.

JULIAN JONES, the founder and Managing Director of ikonsulting Pty/Ltd, is Passionate about the Personal Care Industry in Australia and Globally. Julian has been an active member of the ASCC for over thirty years. During this time he has served as President and Chairman of the Victorian Chapter of the ASCC. He is widely known and well respected both nationally and internationally for his knowledge and skills in developing and marketing the best Personal Care Products

What does a population, that is on average 11 years older in 2100 than it was in 2020, need in the way of skincare that delivers results?

As the population continues to age, skincare becomes increasingly important for maintaining the health and well-being of older individuals as well as the entire population given an older median age. Aging/older skin undergoes various changes that require specific care and attention, so let's look at the key considerations and skincare needs of an aging population.

1. **Moisture and hydration:** Aging skin tends to become drier and loses its natural moisture-retaining capabilities. Therefore, it is crucial to prioritize hydration in skincare for an older population. Moisturisers and serums with ingredients like hyaluronic acid, peptides and ceramides can help replenish moisture, improve skin elasticity, and reduce the appearance of fine lines and wrinkles. I would expect the discovery of many new active ingredients that deliver improved moisturization and hydration will emerge over the time period we are discussing!
2. **Sun protection:** The skin's ability to defend against harmful UV rays diminishes with age, making the elderly more susceptible to sun damage. Continued sun exposure can lead to wrinkles, age spots, and an increased risk of skin cancer. Therefore, incorporating broad-spectrum sunscreen with a high SPF into the skincare routine is vital to protect aging skin from UV radiation. In addition, we have no idea what the normal levels of UV exposure will be by 2100. Whilst it is reported that the "Hole in the Ozone Layer" is reducing, changes in our climate may induce greater levels of UVA and B by 2100.
3. **Gentle cleansing**: Aging skin becomes more delicate and fragile, so it is essential to choose gentle cleansers that do not strip away natural oils or cause irritation. Cream or lotion cleansers are often suitable for mature skin as they are less drying. Additionally, avoiding hot water and opting for lukewarm water during cleansing helps prevent further dryness and irritation.
4. **Antioxidant protection:** Antioxidants play a crucial role in skincare for an aging population. They help neutralize free radicals, which are unstable molecules that can damage cells and contribute to the aging process. Skincare products containing antioxidants like Vitamin C, Vitamin E, resveratrol, or green tea extract can help protect the skin against oxidative stress and improve overall skin health.
5. **Collagen-boosting:** Collagen, a protein responsible for our skin's strength and elasticity, naturally declines with age. To address this, skincare formulations that stimulate collagen production can be beneficial. Ingredients like retinol, peptides, and growth factors can help promote collagen synthesis, leading to firmer, more resilient skin. It will be interesting to see if these benefits can be promoted by non-TGA registered brands and products by 2100!
6. **Targeted treatments:** Age-related skin concerns such as age spots, uneven skin tone and hyper-pigmentation may require targeted treatments. Skincare products with active ingredients that can reduce such uneven skin tone, including Vitamin C, currently exist but so do other ingredients that are currently banned in various countries. I expect much research and innovation in this space over the next 70 odd years!
7. **Eye care:** The delicate skin around the eyes is prone to fine lines, puffiness, and dark circles, which become more noticeable with age. Eye creams or serums specifically formulated for the eye area can help hydrate, reduce puffiness, and minimize the appearance of wrinkles and crow's feet. Hopefully, the key benefit in this area will be a more youthful appearance and not the "Frozen Features" we currently see across the world!
8. **Supportive lifestyle factors:** Alongside skincare, lifestyle factors also play a significant role in maintaining healthy skin as one ages. A balanced diet rich in antioxidants, vitamins, and minerals, regular exercise, adequate hydration, sufficient sleep, and stress management all contribute to overall skin health and vitality. We are seeing an explosion in "oral skincare" at the moment, some of it with very tenuous evidence of efficacy, if any. Hopefully, substantial cause and effect studies will be conducted that validate (or not) some of these products.
9. **Professional guidance:** Consulting a dermatologist or skincare professional can be particularly beneficial for an aging population. They can provide personalised advice, recommend specific products or treatments, and address any specific concerns or conditions related to aging skin. Hopefully, this guidance will come via actual human beings and not frozen faced AI robots!

An aging population has unique skincare needs that require attention and care. Adequate hydration, sun protection, gentle cleansing, antioxidant support, collagen stimulation, targeted treatments, eye care, lifestyle factors, and professional guidance are all crucial considerations. By incorporating these elements into their skincare routines, aging individuals will continue to help advance and maintain healthy, vibrant skin.

Cheers,

Julian

sunscreen highlights

by John Staton
SciPharm Pty Ltd

✓ CHECKLIST TIME FOR ONGOING SUNSCREEN COMPLIANCE!

You may run the risk of having your products withdrawn from sale in Australia and/or New Zealand.

[DISCLAIMER: This information is not complete and is only intended as a general guidance. Consulting a regulatory expert is strongly advised]

It's time to review your sunscreen products for ongoing compliance! Australian regulator Therapeutic Goods Administration "TGA" are currently near the end of a long process of review of sunscreen regulations in Australia. This review covers a number of areas. There has been a substantial amount of industry input into the process and recently, the opportunity for the public to provide comment.

Set out below is a checklist of the major issues covered in various areas of the review. You can use this list to review how your sunscreens stack up now and in your future planning. A list of links to the relevant documents is below.

✓ Do you have Existing Sunscreens?

a. You should use the flow chart included as Amendment 1 to AS/

NZS 2604:2021 [1]. This more clearly identifies if your product is a Primary or Secondary sunscreen and what testing and labelling requirements apply.

b. The Commerce Commission in New Zealand has already passed regulation in the form of the Sunscreen (Product Safety Standard) Act 2022 [2] and has advised Marketers of a deadline of Sept this year for removal of all non-complying products.

c. TGA has concerns regarding the question of sunscreens being used as promotional items for sale or supply by an entity who is not the registered Sponsor of the product. This is where multiple differently branded labels are applied to an existing listed sunscreen. This matter is currently up for discussion with industry peak bodies.

d. Degradation of Octocrylene to Benzophenone is being evaluated internally by TGA and they are developing a position, based on considering limits and validated test methodology.

✓ How about your SECONDARY CLAIMS?

TGA has proposed 3 alternative approaches for secondary claims and these are included in the consultation document [3]. Whatever the outcome, it is most likely that many of these will involve the provision of substantiation by some kind of recognised or validated test methodology. TGA is requesting suggestion of strategies to order to improve compliance.

✓ What Actives do you Use?

The question of which actives will be permitted into the future remains unresolved. Essentially, TGA is awaiting the results of an evaluation process within the FDA in USA [4].

This has the potential to create major reformulation possibilities, resulting in new stability studies and efficacy testing. FDA is requiring updated safety data for ALL of the previous list of old generation UV absorbers were previously Generally Recognised as Safe and Effective (GRASE) by FDA, until previously removed in 2021. This leaves only Zinc Oxide and Titanium Dioxide currently considered to be GRASE by the FDA

✓ Is Your product an AEROSOL or a Pump Spray?

The new versions of AS/NZS 2604 have additional customised requirements for these types of sunscreen products. By implication, relabelling for compliance is required for early 2024.

Spray Rate Related instructions for use

a. There is an ongoing study of aerosol use and performance being conducted at Griffith University [5] and TGA has acknowledged this for consideration for potentially even more instructions regarding usage in the future.

b. Retesting to the new versions of AS/NZS 2604:2021 {6] or AS/NZS 2604:2022 [1]? With the passage of time, existing products will almost certainly need to be re-tested, but for now, focus should be on new products.

✓ For NEW sunscreens, there are a number of considerations.

a. Firstly, they will have to comply with the requirements of the latest version of the Australian Regulatory Guidelines of Sunscreens (ARGS) [7]. This 44 page document includes a comprehensive list of mandatory requirements and is the link between AS/NZS 2604 requirements and TGA requirements. As well it adds requirements for excipients, stability and toxicity for both actives and excipients. It is the primary "go to" guide for auditing of your sunscreen product.

b. Independently, TGA has flagged that they are still concerned about there being differing stability evidence guidelines for sunscreens. The challenge from the regulator is to justify the shorter time frame pre-market as now included in the ARGS, but differing from other therapeutic categories.

✓ Do you Make and/or sell in New Zealand?

NZ will adopt new AS/NZS 2604:2022 as soon as TGA does. Commerce Commission has Sunscreens will not, however be regulated by Medsafe as therapeutics but is likely to occur when the new Therapeutics Bill comes into effect around 2026. The good news here is that if you make in Australia, your reg package will be appropriate for NZ.

WHAT is the Timeline of TGA actions?

According to TGA, the target is 1st January 2024 as a general principle for new products. Industry continues to negotiate in relation to practical aspects such as seasonality, shipping and supply issues and stock recall costs. HOWEVER, as the whole suite of requirements has now been presented, TGA is most unlikely to accept an argument along the lines of not being aware before 2024. SO, DON'T JUST WAIT - YOU SHOULD ACTION NOW.

Documents you will need to look at. Obtain regulatory expert advice!

REFERENCES

1. Amendment 1 to AS/NZS 2604:2022

https://store.standards.org.au/product/as-nzs-2604-2021-amd-1-2022

2. https://legislation.govt.nz/act/public/2022/0004/latest/LMS461350.html?search=ts_act%40bill%40regulation%40deemedreg_sunscreen_resel_25_a&p=1

3. Consultation Paper- Regulation of Sunscreens

https://www.tga.gov.au/resources/consultation/consultation-clarification-and-updates-regulation-sunscreens

4. FDA actives Review

https://www.fda.gov/news-events/fda-brief/fda-brief-fda-announces-results-second-sunscreen-absorption-study

5. Aerosol Sunscreen Report Griffith University

https://www.arpansa.gov.au/sites/default/files/aerosol_sunscreen_report_november_2021.pdf

6. AS/NZS 2604:2021

https://store.standards.org.au/product/as-nzs-2604-2021

7. ARGS Version 3.0 May 2023

https://www.tga.gov.au/resources/resource/guidance/australian-regulatory-guidelines-sunscreens-args

Manoeuvring the Business Travel Insurance Minefield

Business Travel is not the same as before. There are now a number of factors to take into consideration before setting foot onto a flight overseas to attend to Work or an Industry Conference. What are the rules and conditions of the country I am departing from and entering coming back home, when it comes down to the impact of COVID variants?

How will this impact my busy schedule when planning my scheduled dates? If I am connecting with other airlines, or other forms of transport, is there a chance my plans could be disrupted? After all, my business trip will be taking me from one country to another and they all have differing requirements impacting the humble traveller given COVID.

How unpredictable will the consequences be of the ever-changing pandemic and how can this adversely impact my plans and commitments of my forthcoming trip.

In a world of uncertainties, it pays to be prepared.

Just as you would draw up a risk management plan for your own business given the above uncertainties you should be thinking of a contingency plan in the event the unexpected arises for what would normally be a simple business sojourn overseas.

Whatever your plans are , before you leave Australia , we encourage you to refer to the Australian Government website https://www.smartraveller.gov.au/ and have the confidence in knowing how you should prepare for your Business trip. In fact, even whilst overseas we encourage you to refer to this site often.

The SmartTraveller website is also a good source of information for you to use when selecting destinations that you should reconsider travelling to. Here are some recent examples of countries listed as **exercise extreme caution** if travelling to:

Jordan (Middle East), Timor-Leste (Asia) , Mexico (Americas) , Tunsia (Africa),

Cameroon (África) , Türkiye (Europe) , Costa Rica (Americas), Paraguay (Americas) ,

Paraguay (Americas), Morocco (Africa), Seira Leone (Africa) , Malawi (Africa), Kosovo (Europe)

Making sure your Business purchases Corporate Travel Insurance is just as important as making sure you're travelling employee's passports are up to date and valid.

Corporate Travel Insurance is also not the same as it was before given the impacts of the pandemic, however there are travel insurers who are prepared to offer limited cover for COVID-19 related events.

Such covers available in the market may include:

- Medical expenses (including evacuation) if you are diagnosed with COVID-19 whilst on your journey
- Costs incurred that are in association with you changing your travel arrangements if you are diagnosed with COVID-19 before you leave, and your journey is cancelled or amended

Some costs that are usually not covered relating to pandemic caused changes or cancellations;

- Refunds for travelling costs or compensation for rearranging plans in the event of general COVID-19

lockdowns or border closures

- Your loss of deposits, and cancellation related costs arising from a related COVID 19 event. If the travel advice before you leave is do not travel to certain countries and you decide to travel regardless this would not be covered
- You contracting coronavirus (COVID19) or a related disease due to the fact you have not complied with DFAT recommendations, travelled to a country where DFAT has issued a warning of "Do Not Travel" prior to the commencement of the journey or the warning is current at the beginning of the journey; and you have remained in a country after DFAT upgraded the warning to "Do Not travel" and you did not make any reasonable effort to leave the country immediately;

Putting COVID 19 to one side, it can still be the case that when you are overseas your Travel arrangements do not go according to plan. Whether you fall ill (unrelated to COVID), have an accident, an extreme weather event, or Your luggage is lost or stolen. These are but a few examples of events that are usually covered by Corporate Travel insurance.

Example key features of a Corporate Travel policy includes.

- Unlimited overseas medical expenses
- Overseas leisure travel for directors and designated executives, their accompanying spouses, and dependent children - with no age restrictions for most benefits
- Cover for combined business and leisure travel
- Stolen baggage
- An unauthorised use of credit cards etc
- Kidnap and ransom cover
- Search and rescue expenses benefit
- Hire Car Excess Coverage and return of hire car.
- Travel Costs of Replacement staff to complete mission should a covered event occur to initial traveller

And one the most important aspects of your policy is a 24/7 Emergency Assistance Service to hold your hand and guide you through what can be a stressful time

Did you know?

Medical Repatriations

Medical claims continue to top the number of claims recorded for Business Travel Insurance policies. When employees fall seriously ill or are badly injured on their business travels, a medical evacuation to the nearest centre of medical excellence or even sometimes repatriation back to their home country for further treatment is the best chance of a positive outcome .Having access to a 24-hour emergency assistance service enables business travellers to travel with confidence knowing that help is just a phone call away.

If would like to know more about the right Corporate Travel policy to align with your Business needs, please contact the friendly team at IME Insurance Brokers.

James Gillard is the Principal of Insurance Made Easy whose services include – business insurance, travel insurance and financial services. Insurance Made Easy has a client list of over 2000 businesses from all industries. The relevant major insurance schemes are – Hair and Beauty, Pharmaceutical Companies and Natural Therapists.

GOING BACK
TO WHERE IT ALL BEGAN...

by Pam Jones

This is part two of paper number five which is entitled The Formulation of Hair Shampoos. The second part of the paper covers various formulation examples. The formulas are old technology but still interesting to read about. These formulas were the state of the art technology when they were presented in the ASCC Seminar held Friday, 7th and Saturday, 8th May 1965. Enjoy reading a little about our history of hair shampoo in Australia.

PAM JONES has worked in the Personal, Homecare and Pharmaceutical markets for more than 30 years. She has been working out of Asia since 1996 and is well versed and connected with the Asia Market.
Her experience covers technical, sales, marketing, management and training roles. She has qualifications in Chemistry, Marketing and Management. Her company PCA Consulting is well known for its training programmes. Pam has worked with and consulted to companies such as ICI, Croda, Ashland, Huntsman, Reed Exhibitions (in Cosmetics) and Connell to name a few. She is currently serving on the ASCC Technical Committee and volunteers as Technical Editor for this magazine.

The Formulation of Hair Shampoos (Part 2)

Mr. T. Rees
Albright and Wilson (Aust.) Pty. Ltd.

Typical Formulae

Low viscosity

Triethanolamine lauryl sulphate (40% active)	30.0%
Lauric isopropanolamide	2.0%
Triethanolamine sulphate (If required)	
Preservative	gs
Colour	gs
Perfume	gs
Phosphoric acid to pH 6	gs
Water	to 100%

High viscosity

Monoethanolamine lauryl sulphate (27% active	50.0%
Lauric isopropanolamide	2.0%
Monoethanolamine hydrochloride (if required)	
Preservative	gs
Colour	gs
Perfume	gs
Phosphoric acid to pH 6	gs
Water	to 100%
Sodium lauryl ether sulphate (26% active)	50.0%
Coconut diethanolamide	2.0%
Sodium chloride (if required)	
Preservative	gs
Colour	gs
Perfume	gs
Phosphoric acid to pH 6	
Water	to 100%

From these formulae you will see they contain 10 - 11% total fatty matter. This concentration has been found adequate to produce quite a good stable foam on the hair using approximately half an ounce per treatment.

The type of formulations indicated so far may be modified by adding ingredients which are substantive to the hair. These offset the removal of sebum by the basic ingredients, condition the hair and make it more manageable.

In this group are included the ampholytic surfactant's, both acetylated and ethoxylated, and ethoxylated lanolin alcohols and amine oxides. They may be used singly or in conjunction with each other.

The amphoteric additives include among others, alkyl betaines, and alkyl cycloimidinium derivatives. In general this type of compound is characterised by containing in addition to a hydrophobic group at least one cationic hydrophobic group (usually an amino or quaternary

nitrogen) and at least one an ionic hydrophilic group (usually a carboxylic acid, sulphate ester, sulphonic acid).

These cationic and anionic hydrophilic groups can be equal in number (balanced ampholytes) or one or other maybe in excess (unbalanced ampholytes).

According to Mannheimer only balanced amphoterics are compatible with all other types off surfactants. Unbalanced types do not offer any advantages over anionic or cationic types.

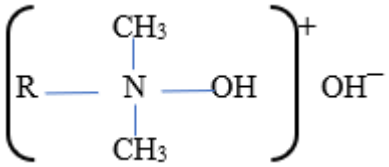
On the acid side of the electric range amphoterics react cationically and on the alkaline side react as anionics. In the iso electric range a balanced amphoteric behaves like a nonionic except that it is a good foamer.

The substantivity exhibited by this type of surfactant to hair is one of the reasons for the incorporation in shampoos.

The use of a mean oxides in shampoo has been mentioned in various patents and it appears that they offer several tangible advantages when incorporated into these products. In general they reduce the static of dry hair, act as a foam booster start in the same way is alkylolamides, give the hair added gloss, increase the ease of combing of both wet and dry hair with less tangling and improve the manageability for several days after washing. The effective addition level ranges from 1.5 - 10%. An amine oxide in hydrated form exists as

particularly in acid solutions. As such it is basic in nature and forms salts with acids. In the hair protein there is an excess of acid groups (the ratio of acid to basic groups is 2:1) and because of this static electricity is produced when a comb is passed through the hair. By using appropriate surface active cations To wash the hair it is probable that the majority of these acidic groups are "neutralised" and little or no static electricity is produced on combing. This is the theory behind cationic rinses but these have several disadvantages. They offer potential danger to the eyes and in addition to this it has been found that continued use of cationic materials causes the hair to become lank and greasy after 2-3 washes so that surface and particulate dirt is picked up very easily.

Amine oxides are not nearly so basic as cationics but their ionic character is sufficient to ensure that the cationic group combines with many of the acid groups in the hair, the result being a reduction in static charge. Irritation is also of a very low order and there may also be an improvement in the potential irritation of the anionic component.



The amine oxides a more effective under acid conditions but the pH cannot be too low as this affects the solubility. If the pH is too low, then, although solubility is improved, there is a loss of substantivity. Add an acid pH the solubility can be improved but the incorporation of an ampholyte according to one patent claim. Lipophilic alcohols derived from lanolin after ethoxylation and acetylation are soluble and substantive to skin and hair. In general the effect of acetylation is to increase the hydrophobic and substantive properties.

Substantive additives such as these can be included to advantage in most types of shampoos but appeared to be specifically useful in shampoos for dry hair.

A typical formula is as follows;-

Acetylated/ethoxylated lanolin alcohol	5.0%
Lauric diethanolamide	6.0%
Diethanolamine lauryl sulphate (34% active)	20.0%
Lauryl dimethyl amine oxide (30% active)	3.0%
Perfume	gs
Preservative	gs
Water	to 100%
pH 6.5 to 7.5	

Other typical materials which can be added to shampoos for dry hair are lauryl alcohols or polyethylene glycol stearate. However, they are not likely to be as effective as additives with substantive properties.

Shampoos for oily hair usually have a slightly larger amount of active matter to cope with the extra oils. An alternative is to incorporate ethanol or isopropanol while another is to replace part of the alcohol sulphate with an alkyl aryl sulfonate. Although this has been done in countries where it is common practise to use a thick hair pomade it is not generally recommended.

Germicidal materials can be added to a shampoo and this is generally done to increase this sales appeal as medicated shampoos. It is difficult to determine if the various types used have any therapeutic value in controlling dandruff and other scalp conditions but as these could be complicated by bacteria they could have a beneficial action in this regard.

The range of additives is quite large and the following list is by no means exhaustive:-

Hexachlorophene
Bithionol
Coal tar solution B.P.
Oil of Rosemary B.P. '58
Trichlorocabinilide
Thymol
Resorcinol
Vancide BN
P-Chlormetaxyol
Undecylenic acid

Selection of perfumes.

Apart from determining the effect of perfume on viscosity it is also desirable to examine its effect in other ways. It should not produce turbidity on standing and also should be compatible with the colouring matter used. pH conditions are generally in the optimum range to prevent degradation of the perfume but the finished product should be shelf tested for this aspect.

Method of Manufacture.

The lauryl, or lauryl ether sulphate, alkylolamide and water together with any other additives such as lanolin derivatives, fatty alcohols or amphoteric surfactants are heated to 60-70 °C using indirect heat until a clear liquid is produced free from solid particles. Allow to cool with stirring. When the temperature has dropped to 35 °C the preservative and perfume are stirred in.

Lotion shampoos.

These may vary from a material with a very low viscosity to a product which is almost a solid cream. Any of the basic surfactants mentioned for clear shampoos can be used. Sodium lauryl sulphate finds greater application in this type of shampoo as cloud point It's not critical.

The alkylolamides perform the same functions as in clear shampoos and in addition modify the crystallisation of the pacifier which imparts the lotion and pearling effect.

Pacifiers which may be used are ethylene glycol monostearate, ethylene glycol distearate, ceto-stearyl alcohol, cetyl alcohol, magnesium, zinc and aluminium stearates.

Additives such as the lanolin derivatives referred to, amphoterics, amine oxides And the germicides maybe incorporated and it is only necessary to ensure their addition does not unduly modify the effect of the opacifying and pearling agent or the viscosity.

Some typical formulae are as follows:-

Sodium lauryl ether sulphate (26% active)	45.0%
Coconut diethanolamide (1:1)	2.5%
Ethylene glycol monostearate	2.5%
Sodium chloride (as required)	
Perfume	gs
Preservative	gs
Water	to 100%

Sodium lauryl ether sulphate (26% active)	20.0%
Sodium lauryl sulphate (34% active)	16.0%
Ethylene glycol monostearate	2.4%
Coconut diethanolamide	4.0%
Perfume	gs
Preservative	gs
Water	to 100%

Ammonium lauryl sulphate (28% active)	20.0%
Ethylene glycol monostearate	2.0%
Lauric diethanolamide (1:2)	4.0%
Stearic acid (TP)	1.0%
Magnesium chloride (6H2O)	0.4%
Phosphoric acid to pH < 6.8	gs
Perfume	gs
Preservative	gs
Water	to 100%

Ethoxylated and acetylated lanolin alcohols	5.0%
Sodium lauryl sulphate (85% active)	11.0%
Glycol amido stearate	3.0%
Lauric diethanolamide	5.0%
Phosphoric acid to pH 6.5	
Perfume	gs
Preservative	gs
Water	to 100%

Viscosity adjustments can be made by the addition of sodium chloride, particularly with those based on sodium lauryl ether sulphate.

It should be noted once again that the perfume can have a noticeable effect on viscosity.

Method of manufacture.

Heat only ingredients together at 60-75°C to give a smooth liquid free from lumps and then allow to cool with slow stirring. When the temperature reaches 35 °C perfume and preservative should be added.

Cream shampoos.

The shampoos in this category can range from a very firm almost solid cream to a soft pearly cream. These are formulated in two ways starting almost always with sodium lauryl sulphate. In the first type thickening is achieved with sodium stearate and the alternative is to thicken with a combination of alkylolamide end cetyl alcohol. The following is an example of the first type of formula:-

Sodium lauryl sulphate (45% active)	33.0%
Stearic acid (TP)	7.0%
Caustic soda (as solid)	1.0%
Perfume	gs
Preservative	gs
Water	to 100%

To manufacture these products the sodium lauryl sulphate, acid and half the water heated and mixed to give a smooth liquid free from lumps. The sodium hydroxide is dissolved in the remainder of the water and added to the other ingredients. The mixture is stirred until it is smooth and homogeneous and then allowed to cool with slow stirring.

The consistency may be varied by lowering or increasing the sodium lauryl sulphate. The formula shown gives a soft pearly cream.

The physical properties may be modified by the addition of various agents.

Lauryl alcohol	up to 1% makes the cream softer and smoother. Larger quantities may cause the cream to become grainy.
Ceto stearyl alcohol	up to 1% makes the cream softer and shiny.
Lauric isopropanolamide	up to 2% makes the cream soft, very shiny, pearly but with a tendency to be stringy.
Coconut diethanolamide	up to 2% gives a similar effect to lauric isopropanolamide but a slightly firmer cream.
Coconut monoethanolamide	up to 2% gives a similar effect to lauric isopropanolamide.
Lauryl ether (three mole)	In equal quantities with lauryl alcohol produces a very soft, very pearly product. Total addition about 3.5%.

Sodium lauryl sulphate (45% active)	25.0%
Lauryl alcohol	0.5%
Lauric isopropanolamide	2.0%
Stearic acid (TP)	7.0%
Caustic soda (as solid)	1.0%
Perfume	gs
Preservative	gs
Water	to 100%

Sodium lauryl sulphate (45% active)	33.0%
Lauryl alcohol	1.7%
Lauryl ether (three mole)	1.7%
Stearic acid (TP)	7.0%
Caustic soda (as solid)	1.0%
Perfume	gs
Preservative	gs
Water	to 100%

When cream shampoos are formulated

without soap the products are more expensive as higher concentrations of sodium lauryl sulphate are required.

Sodium lauryl sulphate (45% active)	40.0%
Cetyl alcohol	6.0%
Lauryl ether (three mole)	1.7%
Perfume	gs
Preservative	gs
Water	to 100%

Sodium lauryl sulphate (45% active)	48.0%
Cetyl alcohol	4.0%
Lauric isopropanolamide	4.8%
Sodium chloride	1.0%
Perfume	gs
Preservative	gs
Water	to 100%

For the above the ingredients are heated and mixed until a uniform melt is obtained. It is cooled with stirring and the preservative and perfume added.

Powder shampoos.

Now becoming less popular because they must be dissolved in water before use and on this count and not as convenient as liquids or creams.

Some suggested compositions are:-

Sodium lauryl sulphate (85% active)	20%
Sodium monoglyceride sulphate	10%
Sodium sulphate (anhydrous)	40%
Perfume	gs

Sodium lauryl sulphate (85% active)	20%
Sodium sulphate (anhydrous)	40%
Borax	40%
Perfume	gs

The former, because it contains sodium monoglyceride sulphate, must be kept neutral and it is therefore more likely to give better manageability and sheen and to harden the hair than the second type.

Jelly shampoos:

Like the powdered shampoos the demand for these has decreased in recent years. They may be made from lauryl sulphates or lauryl ether sulphates thickened with an alkanolamine soap or salt respectively.

Triethanolamine lauryl sulphate (40% active)	40%
Lauric isopropanolamide	0.4%
Oleic acid	20.0%
Triethanolamine	10.5%
Perfume	gs
Preservative	gs
Water	to 100%

The method of manufacture is to mix the water, oleic acid and triethanolamine lauryl sulphate and heat to 60 °C. Add the triethanolamine slowly with gentle stirring. Add preservative and perfume when cool. Transfer to container.

Sodium lauryl ether sulphate (26% active)	50%
Coconut monoethanolamide	4.0%
Lauric diethanolamide	2.0%
Sodium chloride	gs
Perfume	gs
Preservative	gs
Water	to 100%

The quantity of sodium chloride required to obtain maximum viscosity should be determined by laboratory tests. A two or three mole lauryl ether at a level of 2 - 3% can be used as substitutes for the alkylolamides shown.

The method of manufacture is to heat all of the ingredients with stirring until a clear homogeneous liquid is produced and then allow to cool.

Having discussed various methods by which the formulator can achieve the desirable physical and performance qualities required of a shampoo the question presents itself how to select a formulation from all the possible permutations that present themselves.

Formulations can be assessed by submitting samples to subjects who wash their hair and report on the result or half the hair may be washed using the unknown and half washed with a standard and a comparison made by the operator. These methods are time consuming and therefore costly. To prevent unnecessary work it is desirable to have a method of screening formulations to eliminate those that would be unsuitable because of lathering characteristics and foam stability under a soil load.

Methods of doing this have already been referred to but there is another method which has been suggested by Bromley.

Briefly this consists of measuring the specific volume and the viscosity of a foam produced under standard conditions in the presence of a standard soil. The conditions and methods used described and each unknown is compared to a standard of given certain value.

It is claimed that this provides suitable discrimination prior to actual testing on human subjects.

Setting out a questionnaire for panel testing can best be left to the manufacturer as he knows what he wishes to establish but it should cover such questions as:-

- How much leather was there?
- How fast did it build up?
- How easy was rinsy1ing?
- How did the latter feel?
- When you combed your wet hair did it tangle?
- When your hair was dry, how did it feel?
- What was the gloss like?
- How clean did it feel?
- What was it like to manage?
- What about "flyaway"?
- How well did the set hold?
- What did you think of the perfume?

From another standpoint which is quite important shampoos have been tested for their effect on the eyes using the Draize test. I would refer you to a paper reprinted in the I.S.C.C. 15, 209-230, 1964, Which discusses this in greater detail than time permits. Correlation of these results with the effect on the human eye is difficult but it is felt that they indicate where caution should be observed.

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Deepening cosmetic efficacy with Artificial Intelligence.

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Artificial Intelligence (AI) tools have arrived to accelerate our work and to expand our scope of analysis, transforming the beauty industry. We can now train our own algorithms with multiple purposes, we can push the analysis beyond what a probe measures or a scanner acquires.

Moreover, these new tools bring us closer to digital natives and allow us to target a new audience.

The new oil-soluble Argireline® YOUth peptide was developed not only to achieve a prevention of expression wrinkles in the areas that most concern the younger generations, but also to align it with the aspects that most interest them in relation to their lifestyle. They are enthusiasts of beauty products born in the digital era, and they are increasingly looking for cutting-edge tools. To better understand their routines and be closer to their needs, we have given value to their opinions by listening to them and evaluating their facial expressions with AI tools.

For this purpose, we have developed the SmiLearningTM smile rating technology. This system comes from the research field of Facial Expression Recognition (FER) [1,2] of AI that aims to interpret people's facial expressions. With this new technology we can

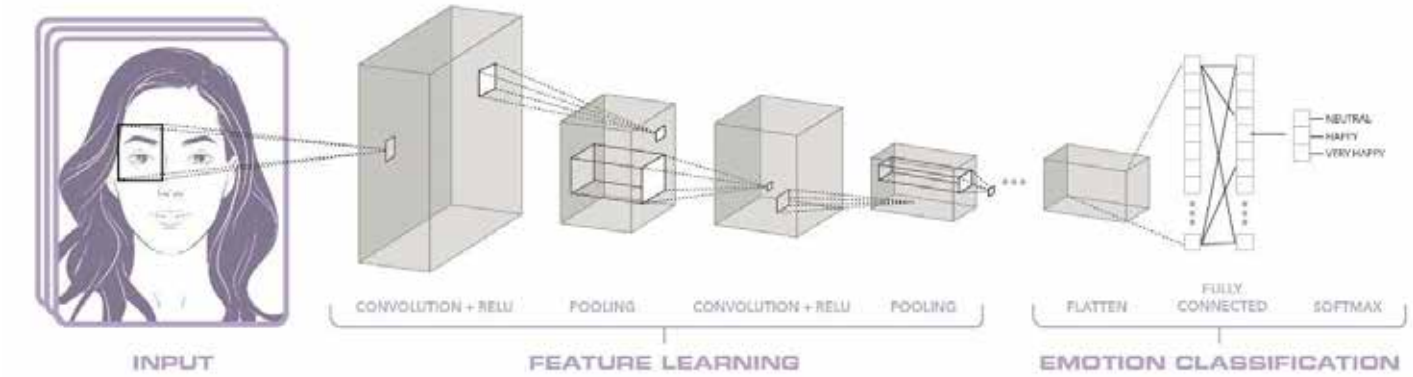

Figure 1. Convolutional Neural Network architecture.

Figure 2. Frame images of a volunteer analyzed with SmiLearningTM smile rating technology method at three different states after the treatment. Workflow of the smile rating technology process.

classify objectively and fast the state of a person into one of the following three categories: neutral, happy and very happy.

To perform this task, we trained a Convolutional Neural Network (CNN) with images extracted from previous studies (Figure 1), where volunteers showed the three emotional states of interest. Training a network is a key step when working with these structures, the data we provide to the network is what it will use to make decisions once it is trained. The more data we have the better, in this case about 3000 images were used to train and validate the network.

The source of data to analyze the grade of satisfaction in the Argireline® YOUth study were videos of the volunteers after using a cream containing 2% active for 28 days. In the video we asked the volunteers to smile according to how happy they were with their skin at the time. From each video we extracted two videos and analyzed both: one before they started smiling and one during the smile. In this way, we were able to set a baseline mood score for that person in that exact moment and we measured how happy they were with respect to it.

In order to compute the happiness score, from each video we extracted frames every 25 milliseconds and our trained algorithm gave a score between 0 and 1 for each category (0 when the category is not activated and 1 for fully activation) for each frame. Then, we did a weighted sum of the three categories to have one score per frame, and finally we computed the average score across all frames of the video. The results determined that after using the Argireline® YOUth peptide for 28 days, volunteers expressed a 22% bigger smile respect to the placebo group.

Argireline® YOUth peptide is a new active ingredient proven to prevent facial expression wrinkles in younger generations. SmiLearningTM smile rating technology helps us to go beyond this conventional efficacy analysis and allows us to explore consumer feelings, quantifying the satisfaction grade of people when using a cosmetic product. Furthermore, we can move forward the simple responses of a typical satisfaction questionnaire, we switch from analyzing one or a few questions to analyzing hundreds of images per volunteer.

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ECOHANCE® Care PS3

PRODUCT PROFILE

FOR NATURAL LOTIONS & CREAMS!

INCI	POLYGLYCERYL-3 DISTEARATE
Type	O/W emulsifier
HLB	11
Usage concentration	2-4% recommended
China IECIC	YES
Biodegradability (OECD 301 F)	Readily biodegradable
Certification	ECOCERT, COSMOS

FOCUS ECO-OPTIMIZATION

REDUCES
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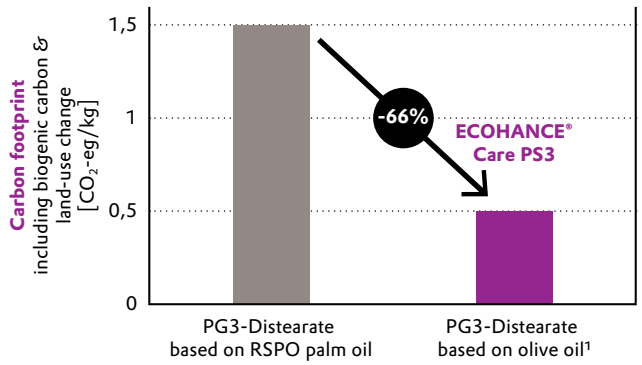
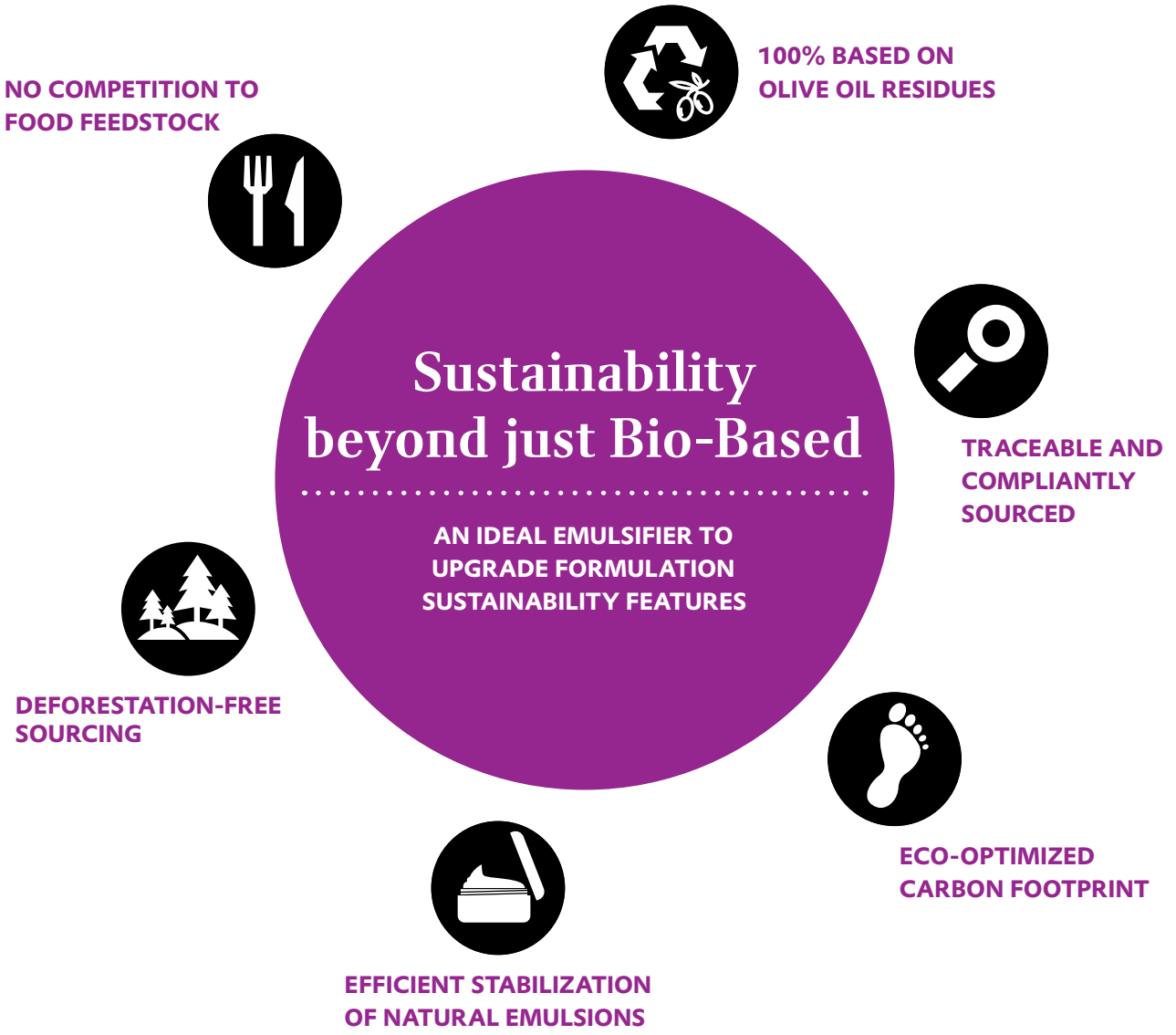
Optimized Carbon Footprint



[1]Calculation based on olive oil not on olive oil residues



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Book Review

Discovering Cosmetic Science

INTERESTING READING

For those who still enjoy a good book (Book - a written or printed work consisting of pages glued or sewn together along one side and bound in covers.) the following article may be of interest.

It is quite some time since I have seen such a glowing review of a science based book.

This article was first published in Chemistry in Australia, chemaust.raci.org.au

DISCOVERING COSMETIC SCIENCE

Discovering cosmetic science Barton S., Eastham A., Isom A., McLaverty D., Soong Y.L. (Eds), The Royal Society of Chemistry, 2021, paperback, ISBN 9781782624721, ebook ISBN 9781788017138, 350 pp., $56–100
Discovering cosmetic science is a really, really great little book. It is well written, filled with interesting and informative discussion about the world of cosmetic science. I am not a cosmetic scientist, initially believing the cosmetics industry was all 'froth and bubble', concerning itself with things people use to adorn their faces, temporarily push back the ravages of ageing or surround themselves with pleasant smells to mask human aroma. And, yes, cosmetic science and the cosmetics industry are about these matters, but very much more besides. There is a lot of very interesting and complex science, including surface science, the science underpinning scents and aromas and the science behind skin and skincare products, all lurking behind the skin-thin veneer of beauty. There is an impressive array of five editors and 20 (including the five) contributing authors. Their brief CVs all suggest they are superbly appropriate and well credentialled/experienced to assemble this book. Possibly, cosmetic scientists are a calmer species, but the thought of getting editorial agreement and convincing 15 other contributors to fall into line fills me with awe! Yet, the book comes together very well. You may have noticed the broad price range quoted for the book (as at May 2022). It certainly pays to shop around and, regrettably, that probably means shopping internationally

Part of the raison d'etre for the book is essentially to make neo-graduates aware of the extent of the industry, its reliance on science and, to an extent, the wide range of interesting and fulfilling careers (including those areas listed above) to be found under the umbrella of 'cosmetics'. Discovering cosmetic science meets this objective splendidly and any graduate seeking to find a career or diversify to another career will find this book a real eye opener. For other readers, there is much fascinating knowledge to be gained from its (relatively few) pages. It will expose you to ideas and complexities you have probably never thought about. That's got to be good! All in all, it is well worth reading. As the Foreword says, 'Discovering cosmetic science is not just another textbook but more an informative journey which takes the reader through the most important and interesting aspects of cosmetic science'. Although 'not just another textbook', the book would be an excellent textbook for a one-semester course in cosmetic science at, say, second-year university level in science and/or arts-based programs. It also certainly set me thinking about deep issues way beyond the scope of the book, like what exactly is 'beauty', why do people paint and tattoo their bodies, and why do we work so acidulously to disguise our human smell. Do I have any answers? Not on your Nellie! The book is well worthy of attention by any curious chemist who wants to know a tad about the cosmetic sciences.

From paper to screen: The major push towards more sustainable and efficient cosmetic trials

by Emanuela Elia
Ozderm

The recent COVID-19 pandemic has spearheaded the uptake of digital alternatives to traditional practices in the world of clinical trials. Previously understood as a typically conservative industry hesitant to move away from in-person activities, hard copies and wet ink signatures, this sudden shift has dramatically changed the way we work. Innovations from technology providers that had previously been ignored for over a decade became an integral part of the move towards more sustainable and efficient clinical trials. Systems that reduce or completely eliminate use of paper and printing, are now widely accepted. These significantly minimise storage and archiving of study documents, and may considerably improve study timelines and expenditure due to the efficient, inherently space-saving, and searchable nature of digital documents. Cosmetic companies conducting trials and trial operators alike have embraced these changes in order to survive, and in doing so bring substantial benefits to our environment.

The changes to clinical research that can have a positive impact on the environment, mainly revolve around two important aspects, with each of them able to generate additional positive outcomes:

1: The use of paper and printing is substantially minimised.
2: The need for physical travel is markedly reduced.

Changes that result in minimal use of paper:

Electronic signature

Apart from making signing contracts between the cosmetic company and the research organisations easier, electronic signatures are an excellent tool when it comes to executing hundreds of informed consent forms between study participants and the research organisation. Electronic informed consent forms make it easier to share, understand and retain information regarding the trial compared to paper forms that can be misplaced.

Electronic documents

Many activities performed by the research organisation, such as screening of the volunteers to determine eligibility for a particular study, can be conducted using electronic documents. Screening questionnaires for example, can be shared securely between different members of the study team.

Electronic data collection (EDC)

Data collected electronically is generally more accurate and traceable compared with handwriting, which can generate confusion and result in queries to verify and rectify the data.

Sustainability outcome

Trials documents may need to be archived for up to 15 years before they can be securely destroyed. Less printing not only has an immediate benefit in terms of use of paper, ink and waste management, but also means less storage needed, as documents can be safely accessed, stored and archived electronically before being permanently deleted.

Efficiency outcome

Searching electronic documents or the data within e-documents is considerably easier and less time consuming, meaning that several tasks delivered by the research organisation can be completed quicker.

Changes that result in reducing physical travel:

Remote studies

Many studies are now focusing on subjective outcomes which are based on the personal perspective or preferences of a person. Subjective outcomes can easily be assessed remotely, reducing the need for the study participant to travel. This also means reducing use of cleaning, sanitizing or other single use protective wear or material, typically used during in-person study visits.

Remote monitoring

Clinical trial monitoring requires data collection and analysis throughout a project to ensure appropriateness of the research and project design, validity and integrity of the data, and protection of human subjects. Traditionally, study monitors based interstate or overseas, used to visit research sites as often as required by the research contract. However, the popularity of new electronic systems that make it easy and secure to share documents and information electronically, has reduced the need for in person monitoring visits

Remote work

Tasks that do not require in person interaction can now be handled remotely by the research centres and the approach toward the research team workforce has changed to be more dynamic and flexible.

Sustainability outcome

Less travel means less use of non-renewable resources, less traffic and less pollution.

Efficiency outcome

Apart from the obvious advantage for workers that can conduct their tasks remotely, reducing physical travel is a great advantage especially for study participants who otherwise would be reluctant to take part in certain studies due to travel distance or feeling uncomfortable with being more exposed. Therefore, reducing or eliminating travel can speed up recruitment targets.

Updating traditional paper-based activities with electronic systems and adopting more flexible study procedures can be challenging for research organizations at the start, but extremely cost effective in the long run. One clear advantage is reaching study goals and meeting timelines more efficiently whilst also supporting a much more sustainable pathway for the environment.

EMANUELA ELIA is the Director of Ozderm, which specialises in in vivo testing and clinical trials for cosmetic and personal care products. Emanuela Elia has a law degree from Rome and a Master of International Business from the University of Sydney. She had collaborated with Australia's longest serving Contract Research Organisation Datapharm for a few years before setting up a cosmetic and personal care products testing facility in 2009. Emanuela is enthusiastic about improving the quality of cosmetic and personal care products' research in Australia through science.

Ingredients Plus Winner of the Best Stand Award

Robert McPherson - Winner of the Lester Conrad Award

Joshua Marlow - Winner of the Jack Jacobs Award

Bree Webster - Winner of the Education Award

Jennifer Cargill - Winner of the Peter Strasser Award

Wrap Up of the **2023 ASCC Conference**

By Matthew Martens

The dust has now settled after a busy few days in Melbourne. After 4 years of planning, and a few false starts along the way, it was with great pleasure that the 2023 ASCC Conference was held at the Crown Convention Centre in May. When I first accepted the role as Chairperson for this conference, it was way back in 2018, when working from home was just a pipedream for most and having an itchy throat in public did not result in being labelled the same as having the plague. There were many challenges along the way but as they say, "Good things come to those that wait". Over the course of the 3 days in Melbourne we had a phenomenal turnout with a record number of 530 attendees from 20 different countries, representing over 250 companies. Our exhibition area was a hive of activity with over 30 different companies exhibiting and no doubt generating numerous follow ups for those hard-working salespeople! Our technical program was packed and spread over 3 concurrent streams with 39 platform presentations, 8 workshops, 1 keynote speaker, 2 plenary speakers and 2 panel discussions, as well as over 20 scientific posters.

I would like to take this opportunity to thank everyone that joined us in Melbourne this year. From all our sponsors but particularly our premium sponsors Avenir Ingredients, Lubrizol, UA Manufacturing, AS Harrison, Brenntag, Ozderm and IXOM. Our exhibitors who went all out to provide such an interactive and engaging exhibition floor by showcasing their latest technologies and innovations. Our platform and workshop speakers for the time spent to put together your presentations and then impart your knowledge and expertise to everyone.

Our conference theme of "From Small Steps to Giant Leaps: Sustainability for a New World" was devised to capture the drive for our industry to do our part to move the Sustainability agenda forward by utilizing the expertise and innovation we are all capable of, to meet the ever-changing needs of the consumer. The challenge is for us all to think a little differently and by taking small steps now we can achieve great things in the future. It was with this in mind when we were choosing our conference guest speakers. Our keynote speaker, Anna Nahajski-Staples from Moneghetti Minerals started the conference off by inspiring us with her journey of breaking through traditions to become a successful businesswomen, founding Moneghetti Minerals, a sustainable gold exploration company, and finding strength to push through barriers when you know "its just the right thing to do for the planet". Our next speaker Professor Vania Leite e Silva, from the Federal University of Sao Paulo in Brazil, wowed us with tales of people taste testing shampoo, as well as taking us on a journey of how academic laboratories are tackling the issue of sustainability without impacting their ability to deliver quality research. Our last plenary speaker was Anhely Millan from Innovation for Future, who enlightened everyone on the need to take a holistic approach to sustainability and that there is not a one size fits all approach.

A big congratulations to our conference award winners who all well and truly deserved their recognition.

Lester Conrad Award for best overall Paper- **Robert McPherson, Lubrizol**

Jack Jacobs Award for best Australia and New Zealand Research Paper- **Joshua Marlow, ANSTO**

Peter Strasser Award for best workshop- **Jennifer Cargill, Carst and Walker**

Education Award for best education paper- **Bree Webster, Activ Ingredient**

Best Poster Award- **Daniel Robustillo, Vytrus Biotech**

Manor Enterprises Award for best exhibition stand- **Ingredients Plus**

A final thank you must go to the organizing committee who worked tirelessly in the background to make the event such a success. It has been an absolute pleasure to work with you all: ***Helen Pearce, Michelle Kane, Eliza Garton, Priscilla Schutz, Nick Urquhart, Mark Basadur, An Ngo, Joyce Ng, Christina Nelson, Rebecca Tam, Rebekah Alcaraz, Stephanie Cavar, Stephanie Yeoh, Andrea Peche and Kate Paulett.***

It is time now to hand over the baton to Deanne and the organizing team for next year's Conference. I am sure it will be another record-breaking year for our conference, and I look forward to surfing the wave on the Gold Coast in 2024.

WINNER – JACK JACOBS AWARD

Small-Angle Scattering for Cosmetic Chemistry

By Dr Joshua B. Marlow, Dr Kathleen Wood
Australian Nuclear Science and Technology Organisation

Overview

Cosmetics and therapeutics are complex formulations of numerous chemical components, which can be more readily designed with specific functional properties if the structure of the components is known.

Small-angle scattering techniques such as small-angle neutron scattering (SANS), small-angle X-ray scattering (SAXS), and ultra-small-angle neutron scattering (USANS) are powerful techniques that allow elucidation of the structural properties of systems with dimensions from a few angstroms to a hundreds of nanometres, including nanoparticles and colloids. The techniques have a long history of providing fundamental information about the structures of surfactants and polymers, their self-assembly, and interactions. One notable advantage is that measurements are performed in the solution state.

The ability to understand the relevant parameters driving structure and self-assembly in solution, including their response to external stimuli such as temperature and shear and, in the case of neutrons, the ability to change the contrast of analyses, make these techniques perfectly suited to the study of cosmetic and therapeutic formulations. In this work, we discuss how these techniques can be, and have been, applied to cosmetic systems, with an eye to future applications.

Introduction to small angle scattering (SAS)

Small Angle Scattering (SAS) is a non-destructive analytical technique that gives information on material structure through analysis of the scattering at low angles of the incident probe, either X-rays or neutrons, Small Angle X-ray Scattering (SAXS) or Small Angle Neutron Scattering (SANS), respectively.

For isotropic samples, such as colloids in suspension, small angle data are given as a simple two-dimensional plot of the intensity of scattering versus wavevector Q. Wavevector Q is related to the scattering angle measured, is inversely proportional to the space scale under investigation and often reported in inverse nanometres or Angstroms.

An example of small angle data, collected on a sample of dilute liposomal solution on the Quokka SANS instrument [1] is given in figure 1. From a simple model independent analysis, the curve gives information such as a radius of gyration of the scattering particle and the aggregation number of the self-assembled complex. Small angle scattering data can also be modelled to geometric shapes using a prior knowledge of the system to extract structural information.

SAS is often called a low resolution technique, as it does not provide information on the atomic length scale, it does however provide high precision information with respect to dimensions and aggregation number[2]. The measurements are relatively fast (seconds for SAXS and hours for SANS) and several advantages over other structural techniques also exist:

- Samples can be measured in the solution state, and therefore the technique is highly suitable to study effects such as concentration, pH dependence, effects of additives, salt etc..
- Various environments can be placed at the sample position, allowing the study of the materials as a function of temperature, shear, electric field, hydration, illumination etc…
- Contrast variation, where the scattering length densities of the molecules of interest and/or the solvent are modified, can be used to effectively mask one component of a multi-component system.

A successful SAXS/SANS study requires knowledge of the sample's composition and requires sample volumes on the order of a mL for SANS, ~10 microL for SAXS.

Here we review some of the applications of SAS relevant to the field of the cosmetics industry.

SAS to study perfumes

Water-insoluble active substances such as perfumes are often solubilised for use in various products. Surfactant micelles can be used to solubilise such additives, and the release of volatile chemicals can be controlled by changing the affinity of molecules such as perfumes to micelles.

In an elegant study Akamatsu and collaborators [3] showed how small angle scattering can be used to study the structures of perfumes solubilised by the common surfactant CTAB. Three different perfumes linalool (LL), l-menthol (LM) and d-limonene (LN) were solubilised in the CTAB surfactant. The intensity versus Q plots, shown in figure 2, were successfully modelled using a charged polydisperse core-shell model to extract the average core radius, shell thickness, polydispersity index, scattering contrast of shell and core portions and surface charge. How the addition of different perfume concentration changes the size of the micelles can be determined from the data shown in panels (a), (b) and (c).

To determine the location of the perfumes in the micelles, a contrast variation experiment is performed and deuterated CTAB used [3]. As deuterated CTAB and D2O have very similar scattering length densities to neutrons, the scattering contrast is small (as seen in figure 2d – the signal of d-CTAB in D2O is 100 times less intense than that of h-CTAB in D2O). By minimising the micellar scattering, the extracted parameters from the data modelling reflect the structural arrangement of the perfume molecules. As can be seen in figure 2(d), the scattering pattern from the hydrophobic perfume (LN, green circles in the figure) is very different to that of the hydrophilic perfumes,

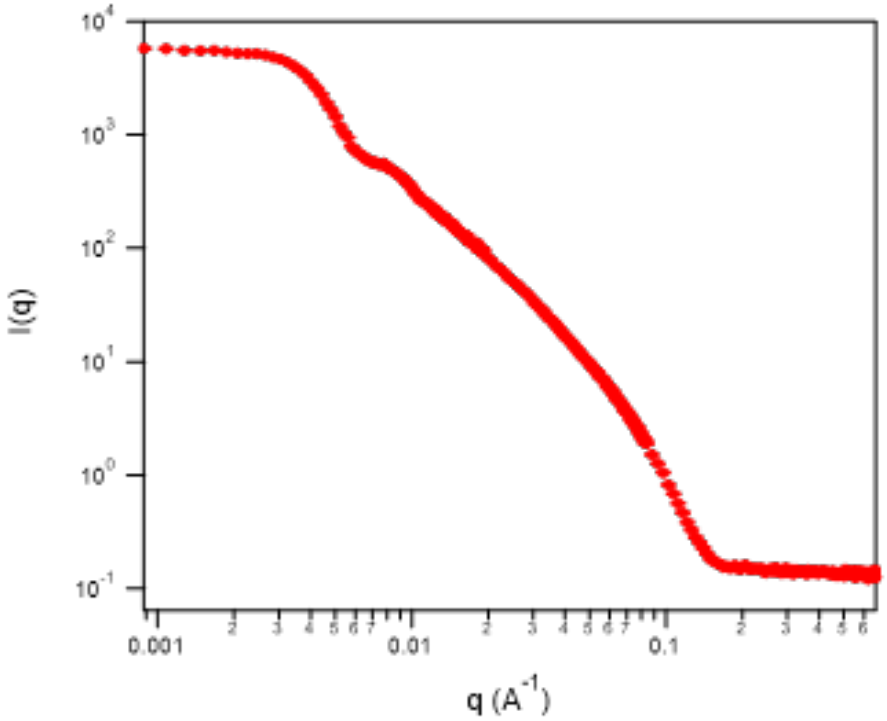

Figure 1. A typical small angle scattering data plot, where the intensity of the scattered beam (X-rays or neutrons) is plotted as a function of wavevector Q

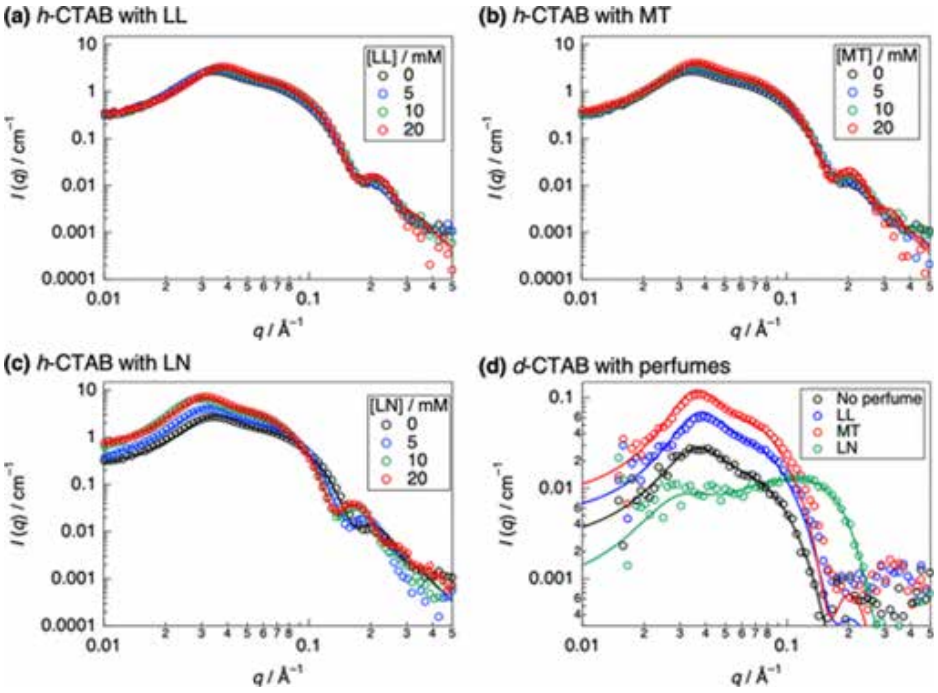

Figure 2. SANS profiles of CTAB solutions of different three different perfumes (LL – linalool, MT – l-menthol and LN – d-limone), reproduced from [3], licensed under CC BY 4.0 [4]. In each panel solid lines represent fits to the data to a charged polydisperse core-shell model. In the h-CTAB samples, the signal is dominated by scattering from the micelles, while in d-CTAB, the perfume molecules dominate the signal. By comparing h-CTAB and d-CTAB results it is possible to extract information about where the perfume sits in the complex.

reflecting the different structures formed.

Via careful data modelling, the authors found that the solubilisation of the hydrophilic perfumes, linalool (LL) and l-menthol (LM), occurs via their incorporation in the micelles and does not change the size of the CTAB micelle. On the other hand, the hydrophobic perfume, d-limonene (LN), is solubilised via the incorporation of the perfume in the core of the droplets, and a resulting larger micellar radius was determined.

Since the reported study is in the

solution state, the authors note that future work can include time-resolved studies to investigate the dynamics of release process of perfumes.

SAS for Lipid Nanoparticles

Lipid nanoparticles (LNP) are the crucial delivery agent in the recent highly successful mRNA vaccines against COVID-19 [5]. LNP act as a protective capsule for nucleic acid cargo to prevent degradation and have applications in cosmetic products [6].

Sebastiani et al showed that SANS can be used to determine the spatial distributions of individual LNP components [7] and confirmed that the mRNA lipid nanoparticles have a core-shell structure. The authors completed an impressive set of contrast variation experiments varying deuteration levels of both the LNP components and solvent, and successfully co-refined a large number of datasets to determine structural parameters. The results indicate that cholesterol is 2-4 times more likely to be found near the surface of the LNP than in the centre.

Once the LNP interact with the body, they are affected by interactions with proteins. In [4], the authors show that SANS can be used to study how the lipid nanoparticles are rearranged in the absence and presence of a protein. The binding of the protein induces a redistribution of the lipids in the shell and core, and ultimately causes release of the mRNA.

SAS for Gels

The small angle technique has proven to be amenable to studying the gel phase of matter [8]. A recent example of how both small angle scattering, both X-ray and neutron, and Ultra Small Angle Neutron Scattering (U-SANS) can be combined to study the gels formed by milk is given in [9].

On digestion by newborns, infant formula forms a curd in the acidic environment of the stomach, and as such the gelation process is of interest to understand how the structure of milk changes due to the different physicochemical conditions it encounters. The authors of [9] showed that cow and goat skim milk and infant formulae gels have different mechanical properties. By using scattering, they were able to show how these relates to underlying microstructure. They find that cow gels have a stronger gel strength than goat milk gels, which correlates to a denser structure.

SAS for wormlike micelles

Wormlike micelles are elongated micelles that have unique viscoelastic properties, which make them useful as rheological modifiers in various industries. Various surfactants can spontaneously form wormlike micelles, and their structures in the solution state can be characterised by SAS. An excellent example of how a systematic study of additives can allow the design of self-assembled micelles of varying structures and rheological properties is given in [10].

The authors of [10] used a model zwitterionic surfactant that spontaneously forms viscoelastic wormlike micelles in aqueous solutions. SANS data from the pure surfactant at various concentrations modelled with a flexible cylinder shows that the contour length of the wormlike micelles can be varied as a function of surfactant concentration.

Once the behaviour of a surfactant system in the pure form is well understood, it is possible to explore how additives affect the self-assembled structure. SANS and U-SANS data collected in [10] on the zwitterionic surfactant and different additives reveals changes in the assembly. Inclusion of non-polar additives resulted in a change from long wormlike micelles into microemulsion droplets at a critical concentration. In contrast, polar additives induced little deviation from the wormlike structures.

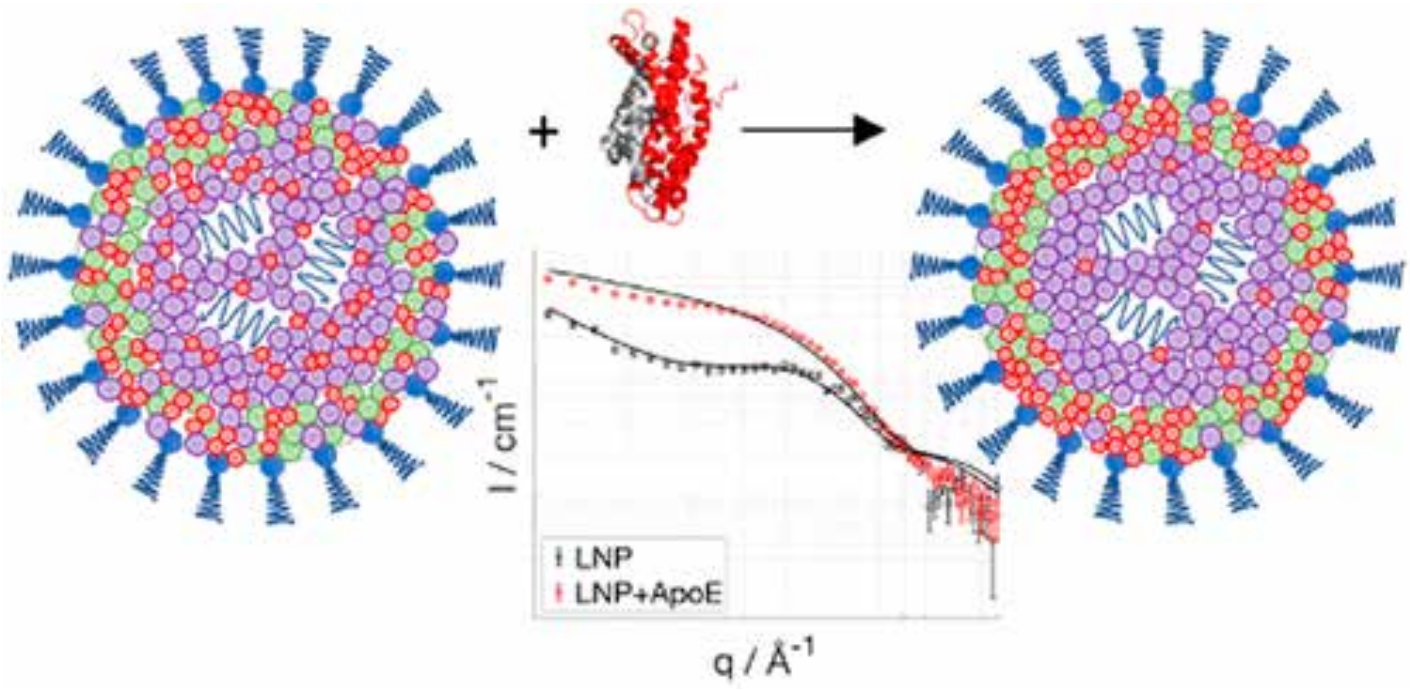

Figure 3. Reproduced from [7], under creative commons license CC BY 4.0[4]. Small angle neutron scattering data of lipid nanoparticles with and without a bound protein is given in the middle of the figure. A sketch showing of the lipid nanoparticle structure, deduced from an extensive data set of various H/D contrasts, is given on either side of the plot. Red sphere – cholesterol, green sphere – DSPC, blue sphere and tail – PEG-lipid (DMPE-PEG), blue lines – mRNA, purple sphere – cationic lipid MC3 (DLin-MC3-DMA),

SAS in Australia

Characterizing the structure of molecules in solution or gel form on the nanoscale is necessary in order to rationally design complex formulations of use in the cosmetics industry. SAXS and SANS are particularly well suited to such studies.

The Australian research community is well served in terms of SAXS and SANS capabilities. In addition to many laboratory based SAXS instruments now installed in universities and research institutes, world class synchrotron and neutron instruments are available, operated by the Australian Nuclear Science and Technology Organisation (ANSTO):

- The Australian Synchrotron in Melbourne has a highly successful and flexible SAXS beamline [11], and a second one dedicated to SAXS on liquid samples has recently been commissioned [12].
- The Australian Centre for Neutron Scattering operates three neutron instruments, two SANS instruments [13,14] and one U-SANS [15], along with a laboratory based SAXS instrument for complementary measurements [12].

ANSTO's SAS capabilities are available to the research community via peer-reviewed merit access for academic work, and via a user pays model for commercial access.

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WINNER – LESTER CONRAD AWARD

Naturally increasing phytochemical complexity in botanical extractions using a highly efficient, low environmental impact and sustainable technique.

Robert McPherson[1], Helen Pearce[1], Bianca McCarthy[2], Rebecca Chisholm[3]; Fan Yang[3]; Jung Mo Kim[3]; Júlia Comas[4]; Sylesh Venkataraman[3]; Raquel Delgado[4]

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Abstract

Against the backdrop of the climate crisis, more and more consumers, especially from younger generations, are looking to exclusively purchase sustainable products. Finished goods as well as raw materials that are sustainable, environmentally friendly, low-in-carbon footprint, energy efficient, and cruelty-free will become mainstream in a push to create a better world. However, for natural extracts, traditional and mainstream techniques still employ the use of undesirable organic solvents that can potentially have a negative environmental impact and often contain low or a narrow range of phytocomponents, making the product less efficient. In other words, traditional techniques fail to meet the future requirements for effective and sustainable products. Subcritical Water (SCW) Extraction is a novel process to make botanical extracts. This technology uses water as the sole extraction solvent. Water, being inexpensive and environmentally friendly, is therefore an ideal solvent for natural extracts for cosmetic applications. The process itself is focused on manipulating the variables of temperature and pressure in such a way that the water transforms itself and modifies its own characteristics. In this way, the polarity of SCW is tuneable to resemble various organic solvents. Such changes in polarity, determined by the dielectric constant, allow the extraction of a broader range of phytoactives, from fat soluble vitamins to water soluble minerals.

This paper will discuss the effect of extraction variables on the profile of the botanical and compare with traditional extraction techniques and demonstrate via case studies and using 360° analysis on how this extraction technique can deliver superior plant based active ingredients with abundance of Phytoactives compared to traditional methods.

1.0 Introduction

Chemical extractions are an everyday occurrence, whether you're making your morning coffee, lunchtime smoothie, or bedtime tea. We are constantly transferring mass from one phase into another. Just like making the perfect morning coffee, many different attributes are important in the process including temperature, pressure, and time.

Water is an ideal extraction solvent because it is inexpensive and environmentally friendly. It is a highly polar solvent, characterised by a high dielectric constant, which means that sugars, polysaccharides, and minerals can be readily dissolved. These same characteristics also mean water is unsuitable for the extraction of non-polar compounds, especially at ambient temperature. The dielectric constant of water can be reduced when the temperature is elevated, indicating that more hydrophobic compounds can dissolve in water. However, if the temperature exceeds the boiling temperature of 100°C, water enters the gaseous phase, rendering it ineffective as an extraction medium. It is for this reason that organic solvents are typically required to extract hydrophobic proteins, fat soluble vitamins, and unsaponifiable lipids from natural compounds. The environmental impact of the use of organic solvents is out of step with the modern consumer, who is seeking sustainable, environmentally friendly, low-in-carbon footprint, energy efficient, and cruelty-free in all aspects of their lives. The recent introduction of SCW Extraction technology to the extraction of natural compounds offers an innovative solution to this problem.

SCW Extraction is a unique and powerful extraction technique that allows for the extraction of a broad range of phytoactives from plant matter, using water as the sole extraction solvent. Simply put, this technology regulates air pressure to keep water in a liquid state between the boiling point (100°C) and the critical point (374°C). That is, even when the temperature exceeds the normal boiling point, the water is still in a liquid state (Figure 1). By manipulating water temperature and pressure in this way, the water transforms itself and modifies its own characteristics. The role of this technology in the extraction of natural compounds from plant matter for the cosmetic industry, relative to traditional methods, will be explored in this paper.

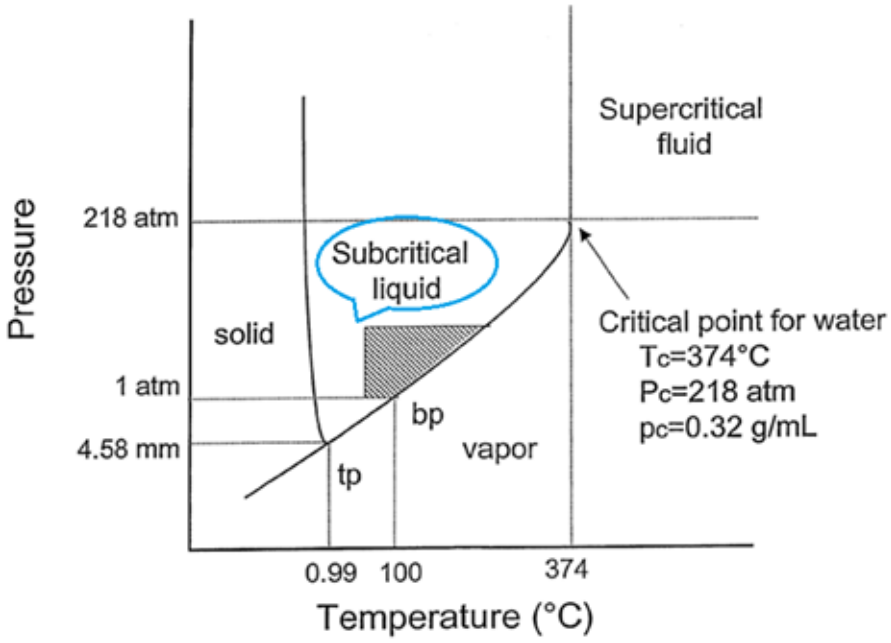

Figure 1. Phase diagram of water as a function of temperature and pressure.

2.0 The effect of extraction variables on SCW extraction technique

2.1 Method

Dry plant matter of Zataria multiflora (Z. multiflora), green tea, pomegranate, chamomile, rosemary, and lavender were obtained from farms in Bordeaux, France.

For SCW Extractions, temperature was varied from 100°C to 175°C and extraction time was kept constant at 90 minutes. The chemical profile of the extracts was measured by HPLC-DAD (280nm).

For conventional maceration, either water or 50% ethanol, or a blend of the two, was used as the primary solvent and extraction time was set at 24 or 48 hours. The chemical profiles of the extracts were measured by HPLC-DAD (280nm), Folin-C UV spectrophotometry, and headspace gas chromatography, using methods recommended by the manufacturer.

3.0 Results and Discussion

3.1 The polarity of water changes with changes in temperature and pressure

At room temperature, polar organic compounds are more soluble in water than apolar compounds. When water temperature and pressure are increased, the dielectric constant is reduced. Indeed, under these conditions, the polarity of SCW becomes similar to that of organic solvents (Figure 2,3) [1,2,3].

Substance	Dielectric Constant
Water	80
Dimethysulfoxide	49
N,N-Dimenthylformamide	37
Methanol	33
Ethanol	25
Acetone	21
Tetrahydrofuran	7.6
Chloroform	4.8
Benzene	2.2
Hexane	1.9

Figure 2. - Dielectric constant of various solvents at 20°C and ambient pressure.

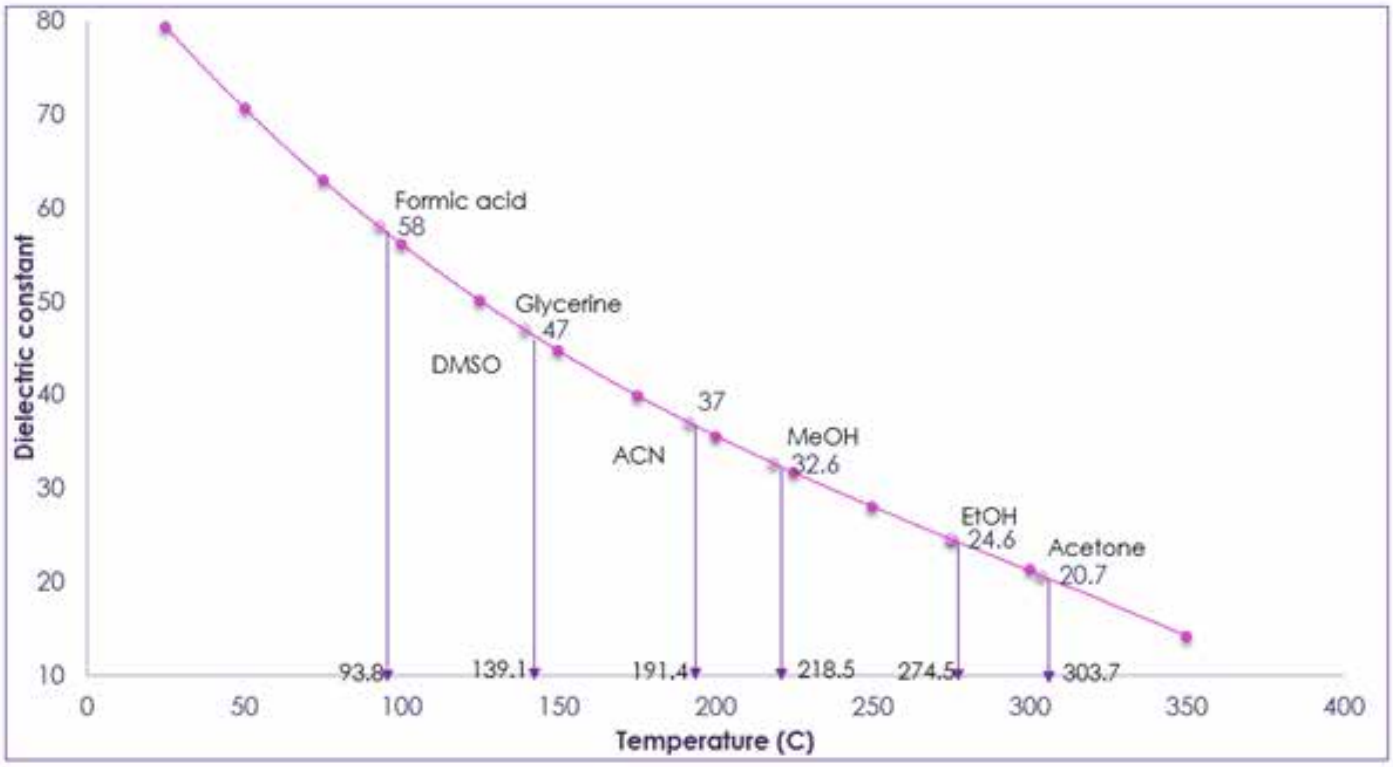

Figure 3. - Dielectric constant of water as a function of temperature at 20MPa

3.2 SCW Extraction allows for the extraction of water insoluble compounds

SCW Extraction of rosemary and lavender were carried out to determine the extent to which aromatic/fragrant water-insoluble compounds could be obtained. The quantification of aromatic compounds was carried out using headspace Gas Chromatography. Figure 4 shows the water insoluble components extracted from rosemary and lavender using SCW Extraction: linalool, eucalyptol, and camphor. These results indicate that even apolar components can be extracted from Lavender and Rosemary using SCW Extraction technique. Indeed, the ability to manipulate the dielectric constant of water allows for the extraction of a broader range of phytoactives from fat soluble vitamins to water soluble minerals (Figure 5).

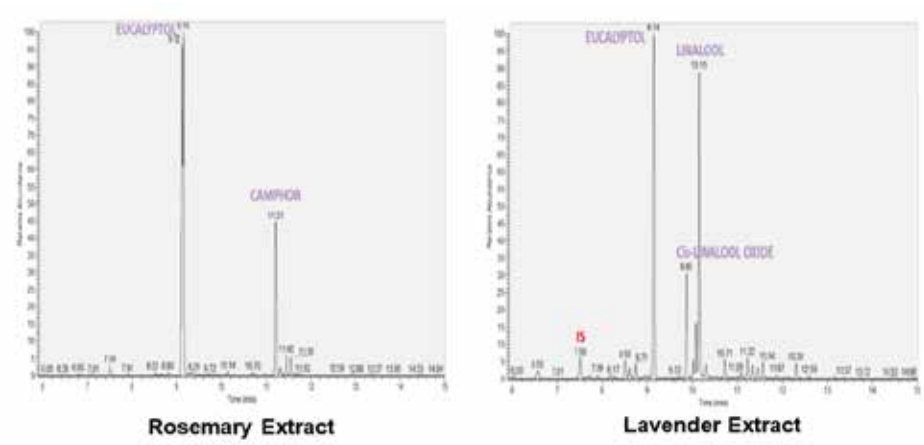

Figure 4. the water insoluble components extracted from rosemary and Lavender using SCW

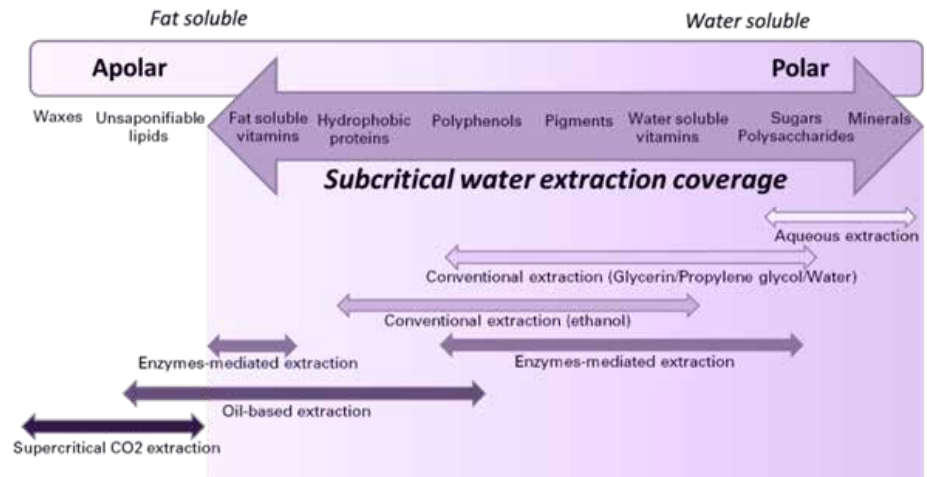

Figure 5. - The range of phytoactives that maybe extracted using SCW extraction

3.3 The chemical profile of the extract can be varied by water temperature

There are several critical parameter conditions required when it comes to achieving the most efficient extraction, one of which is the

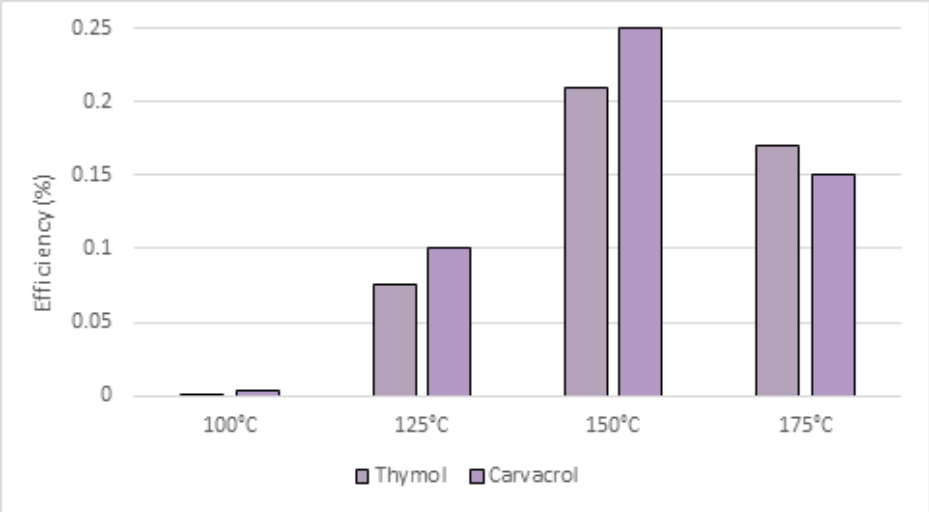

Figure 6. - Extraction of Thymol and Cavacrol from Z. multiflora over different temperatures.

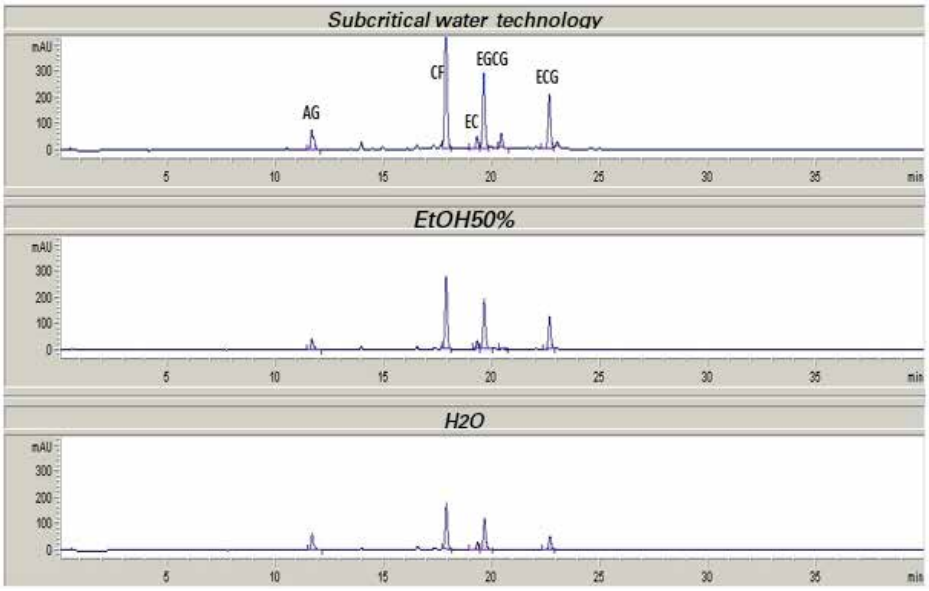

Figure 7 – HPLC-DAD chromatogram comparison of green tea phytoactive under different extraction techniques.

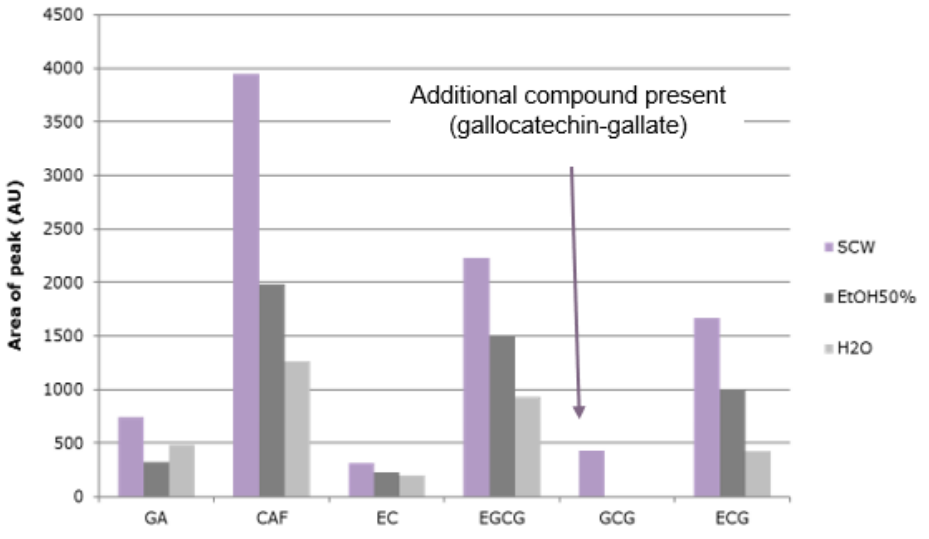

Figure 8. –comparison of Phytoactives extracted from green tea using different extraction techniques

extraction temperature. Selecting the right extraction temperature is critical to obtain the most efficient and highly concentrated phytoactives. As temperature increases, there is a subsequent decrease in permeability, viscosity and surface tension and an increase in diffusion rate. Therefore, it is most beneficial to conduct SCW extractions at the highest possible temperature before thermal degradation of the phytoactives begin. The maximum possible temperature for each individual plant species must be obtained by experimental means considering the target phytoactives we want to optimise the extraction of.

The SCW extraction of Z. multiflora using different extraction temperatures, whilst keeping all other parameters the same, show that the relative amounts of Thymol and Carvacrol vary depending on the temperature. The results showed that the optimal temperature range for extracting Thymol and Carvacrol was 150°C, after this temperature thermal degradation began (Figure 6.) Other factors to consider when optimising the extraction process is the flow rate of the water, and the particle size both these criteria's also must be optimised depending on the target phyoactives and plant species [3].

3.4 SCW Extraction allows for the extraction of novel compounds not seen in conventional maceration

SCW extraction technique was compared to conventional maceration to determine differences in chemical profiles of the extracts. Using green tea as the botanical source, a 90-minute SCW extraction method was compared against maceration in water for 24 hours and maceration in 50% ethanol for 24 hours. The target phytoactives (Gallic acid (GA), Caffeine (CF), Epicatechin (EC), Epigallocatechin-gallate (EGCG), Gallocatechin-gallate (GCG), Epicatechin-gallate (ECG) were analysed by HPLC-DAD (280nm). The chromatogram (Figure 7) was compared, and the results were quantified (Figure 8).

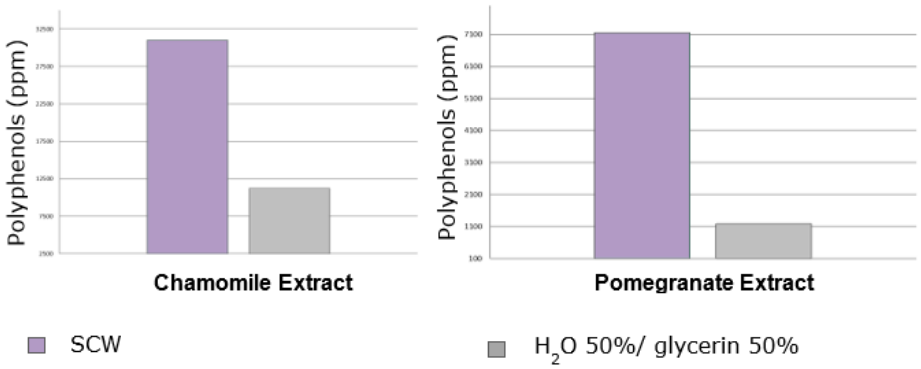

Figure 9. – comparison of the total polyphenols extracted

The results show that, using the SCW Extraction technique, an additional phytoactive "gallocatechin-gallate", an apolar compound, was extracted. This compound was not observed in either maceration methods.

3.5 SCW Extraction allows for the extraction of a higher concentration of phytoactives, when compared to conventional maceration

Using pomegranate and chamomile as the botanical source, a 90-minute SCW extraction method was compared against convention maceration of 50% water and 50% Glycerine for 48 hours. The total polyphenols were quantified by Folin-C UV spectrophotometry. The results in Figure 9 demonstrate significantly higher levels of polyphenols compared to the conventional maceration. These results mirror those from the green tea extract, which also demonstrated a higher level of extracted phytoactives compared to maceration techniques (Figure 8).

4.0 Case Study and 360° analyses of 3 plant based active ingredients.

4.1 Method

An analytical examination of the phytoactive compositions of botanical extracts prepared by SCW extraction technology and two traditional extraction techniques was completed. The phytoactive products, developed with the SCW extraction technology, used for this examination include a Myrothamnus flabellifolia leaf/stem extract, a Ligustrum lucidum seed extract, and a Stevia rebaudiana leaf/stem extract. The Myrothamnus Flabellifolia leaf/stem extract ingredient is a botanical extract that helps naturally obtain longer and fuller eyelashes and eyebrows for a more revived and beautiful look. The Ligustrum lucidum seed extract ingredient is a botanical extract that mimics the Tibetan genetic adaption of hypoxia conditions for increased oxygen supply to the skin, resulting in glowing and healthier looking "yoga skin". The Stevia rebaudiana leaf/stem extract is a vegan-friendly ingredient with retinoid-like results that minimizes the appearance of wrinkles for younger looking skin. Hot water and aqueous glycerin extracts of the botanicals were completed to use as baselines for temperature and solvent variables. The hot water extractions consisted of heating 5% of the botanical in 45°C water, while mixing, for 4 hours before diluting with glycerin and filtering until clear. The aqueous glycerin extractions were made similar to the hot water, but with an 80% glycerin in water solution at 45°C. The Myrothamnus Flabellifolia leaf/stem extract and Ligustrum lucidum seed extract are made with 80% aqueous glycerin while the Stevia rebaudiana leaf/stem extract is made with 60% aqueous glycerin.

4.2 Comparison of the proximate composition of botanical extracts

To evaluate the differences in techniques in botanical extract compositions, the proximate analysis of the extractions, including total proteins, carbohydrates, and lipids, were analyzed. Total proteins were analyzed using the BCA assay method. Lipid and carbohydrate content were analyzed by GC-FID. Total phenolic content was determined by the Folin Ciocalteu UV assay.

The proximate analysis of Myrothamnus includes proteins, carbohydrates, and phenolic compounds (Figure 10). Due to the naturally low lipid content of the botanical, the lipids were undetectable in the extracts, so are not included in the data set. The Myrothamnus extract created with the SCW extraction technology contained 12% more proteins than the hot water extract and 80% less than the aqueous glycerin extract. The aqueous glycerin extraction contained 91% more proteins than the hot water extraction. The SCW extraction extract contained 12% more carbohydrates than the hot water extract and 40% less than the aqueous glycerin extract, while the hot water extract contained 30% less than the aqueous glycerin extraction. The SCW technology extracted 16% more phenolic compounds than the hot water and only 6% less than the aqueous water extraction. The phenolic content of the aqueous glycerin extraction was 21% more than the hot water extraction.

Extracts made from Ligustrum contain proteins, carbohydrates, lipids, and phenolic compounds (Figure 11). The SCW Extract contained 65% more proteins and 22% more carbohydrates than the hot water extract. The hot water extract contained 27% more lipids than the extract made by the SCW technology. The aqueous glycerin extracts contained 160% more protein as well as 43% more carbohydrates than the hot water extract. The lipid and phenolic compound contents of the hot water and aqueous glycerin extracts were relatively similar with the aqueous glycerin extracts having about 4% more of both these compounds than the hot water extracts. The SCW technology extracted 60% more phenolic compounds than the hot water and 57% more than the aqueous glycerin extractions.

Stevia extracts contain proteins, carbohydrates, lipids, and phenolic compounds (Figure 12). The SCW Extract contained 141% and 123% more protein than the hot water and

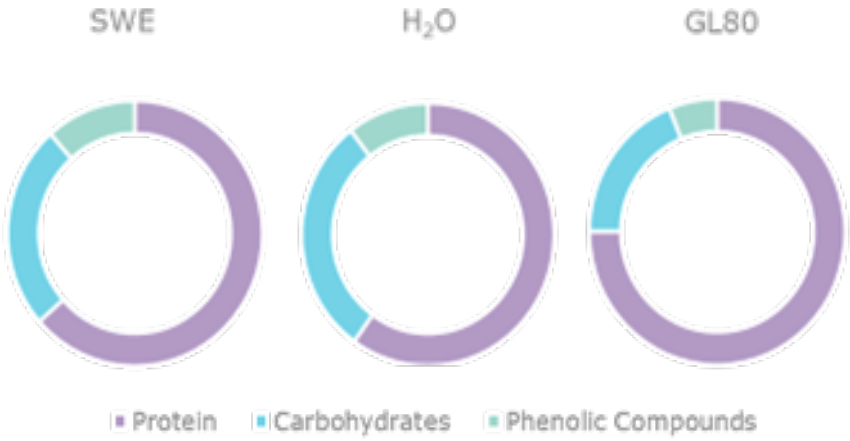

Figure 10: Comparison of the proximate analysis of compounds extracted from Myrothamnus flabellifolius.

Figure 11: Comparison of the proximate analysis of compounds extracted from Ligustrum lucidum.

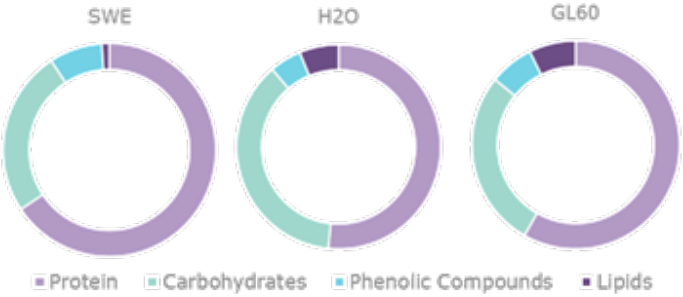

Figure 12: Comparison of the proximate analysis of compounds extracted from Stevia rebaudiana.

aqueous glycerin extracts, respectively. The aqueous glycerin extract contained 31% more protein than the hot water extraction. The carbohydrate content of the SCW Extract is 102% greater than the hot water extraction and 109% more than the aqueous glycerin extract, while the hot water extract contained 10% more than the aqueous glycerin. In regard to the lipid content, the aqueous glycerin extract contained 52% more than the SCW Extract and 34% more than the hot water extraction. The hot water extraction contained 18% more than the SCW Extract. The phenolic compound content of the SCW Extract was 151% and 125% more than the hot water and aqueous glycerin extractions. The hot water extraction was 49% less than the aqueous glycerin extraction.

By generalizing phytochemical compounds into broader classes or families, an overview of the efficiency of extraction techniques can be evaluated. Extraction efficiency is complex and has many variables, including how the botanical matrix affects compound extractability. In the case of the Stevia extractions, the ability of the SCW technology to extract phenolic compounds is superior to the hot water and aqueous glycerin extractions.

Compound categories are important to determining the concentration of the extract and offer alternative options to describing quality of extracts vs the individual identification of single compounds, which is time consuming and costly. By analysing the general categories of the extraction techniques, botanical extracts can be evaluated for best extraction technology to meet literature-based phytoactive compositions for efficacy and complexity.

4.3 Active compound comparison of botanical extracts

While the benefits of botanical extracts come from the whole phytochemical composition, the botanicals do contain specific compounds known to directly contribute to the extract activity. These individual compound actives, based on literature studies, have shown benefits of botanical extracts in personal care products. By better removing these compounds from the botanical materials, extracts have increased efficacy and efficiency. This increases the sustainability of the process and reduces the amount of raw material needed for extraction. The proximate analysis of the botanical extracts previously discussed showed that in general categories of compounds, the SCW technology was not the optimal technique for all phytochemical categories. Nonetheless, regarding extraction of specific compounds with known efficacy, the SCW technology is superior or at least comparable in extracting these important compounds from complex botanical materials.

Myrothamnus extracts contain many proteins, carbohydrates and phenolic compounds, but it is the carbohydrates and phenolic compounds that are of interest. Specifically, 3 compounds were detected, which according to literature, may present beneficial properties for hair. Kaempferol glucuronide is known to increase proliferation of hair follicle cells. Miquelianin decreases hair fall by reducing serine phosphorylation, which disassembles the connections that anchor hair in the follicle. Trehalose helps retain moisture in the hair and retain curl in lashes. These two phenolic compounds and one carbohydrate are the active compounds analysed to illustrate the efficacy seen in the Myrothamnus Flabellifolia leaf/stem extract ingredient.

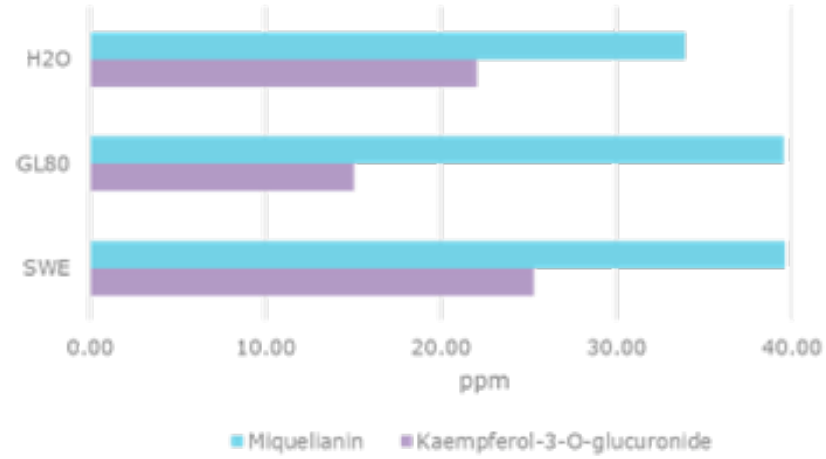

Figure 14: Comparison of the kaempferol glucuronide and miquelianin content extracted from Myrothamnus flabellifolius.

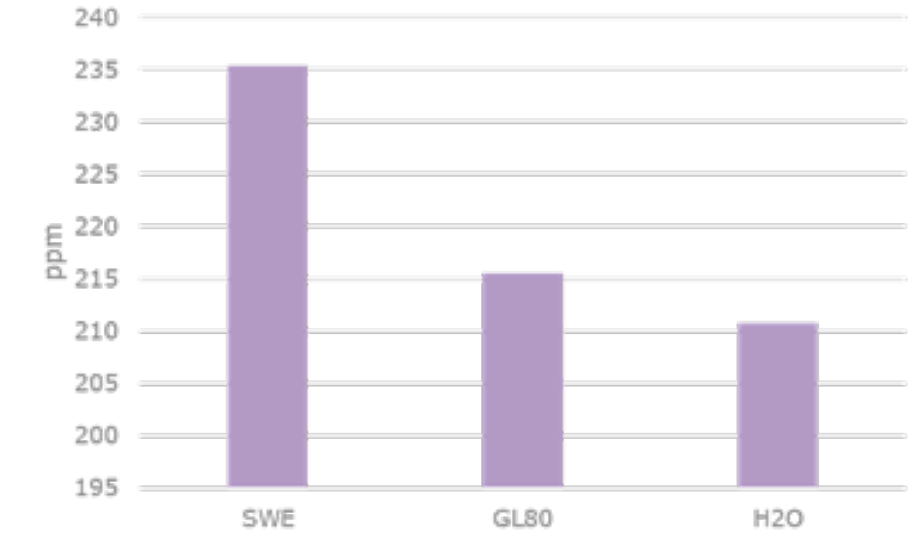

Figure 15: Comparison of the compounds beneficial for hair extracted from Myrothamnus flabellifolius.

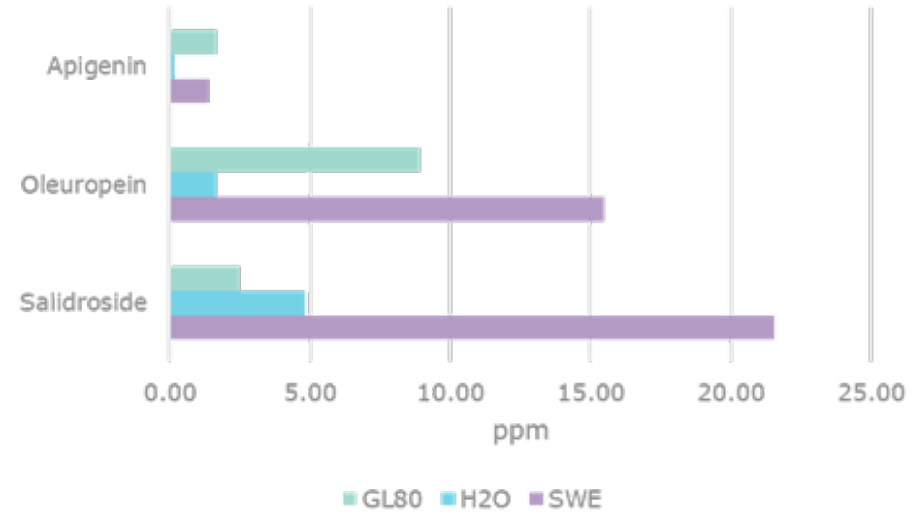

Figure 16: Comparison of the active phenolic compounds extracted from Ligustrum lucidum.

Trehalose is a disaccharide abundant in Myrothamnus and is easily soluble in water, which is reflected by the similar amounts extracted by all three technologies (Figure 13). The SCW technology was able to extract about 7% more than that other two techniques, but the aqueous glycerin only extracted 4% more than hot water.

Analysis of the kaempferol glucuronide and miquelianin phenolic compound comparison showed how solvents affect the solubility of compounds. The kaempferol glucuronide was better extracted by SCW and hot water extractions than the aqueous glycerin extract with SCW extracting 14% more than the hot water and 51% more than the aqueous glycerin (Figure 14). The hot water extracted 38% more than the aqueous glycerin extracts of Myrothamnus. Evaluation of the miquelianin extraction showed that the three techniques were similar. The SCW Extract and aqueous glycerin extractions had almost identical amounts with less than 0.5% difference, while the hot water extract content was 15% less compared to the other two techniques.

The total compounds beneficial for hair in each extraction technique showed that the SCW extracted 11% more beneficial compounds from Myrothamnus compared to hot water extracts and 9% more than aqueous glycerin extracts (Figure 15).

Extracts made from Ligustrum Lucidum reduce hypoxia in skin, allowing increased oxygen levels that mimic levels seen after yoga sessions. Literature has identified 2 genes involved in protecting the skin from low oxygen conditions and 3 phenolic compounds have been determined to help activate these genes. Salidroside, oleuropein, and apigenin are known as arginase inhibitors and contribute to efficacy seen in the Ligustrum lucidum seed extract ingredients.

The SCW technology was able to extract salidroside and oleuropein better than the hot water or aqueous glycerin techniques combined (Figure 16). Salidroside was extracted 127% and

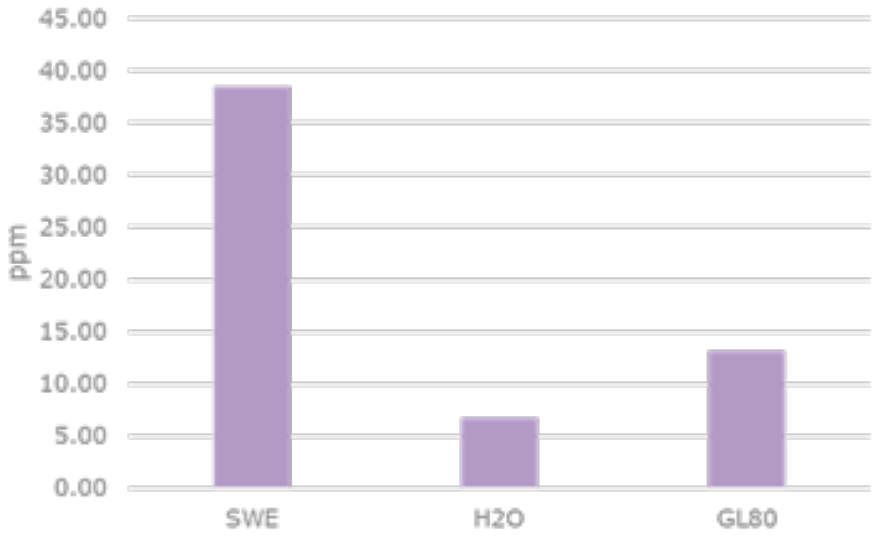

Figure 17: Comparison of the total arginase inhibiting compounds extracted from Ligustrum lucidum.

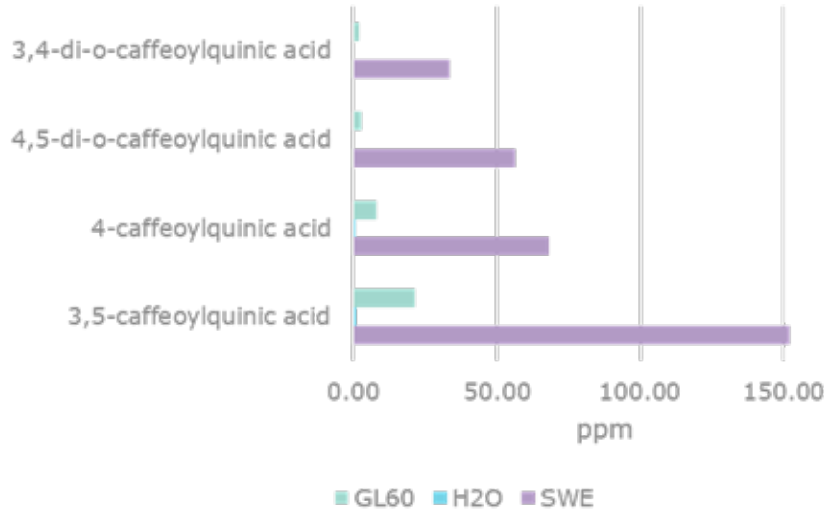

Figure 18: Comparison of the caffeoylquinic acid derivatives extracted from Stevia rebaudiana.

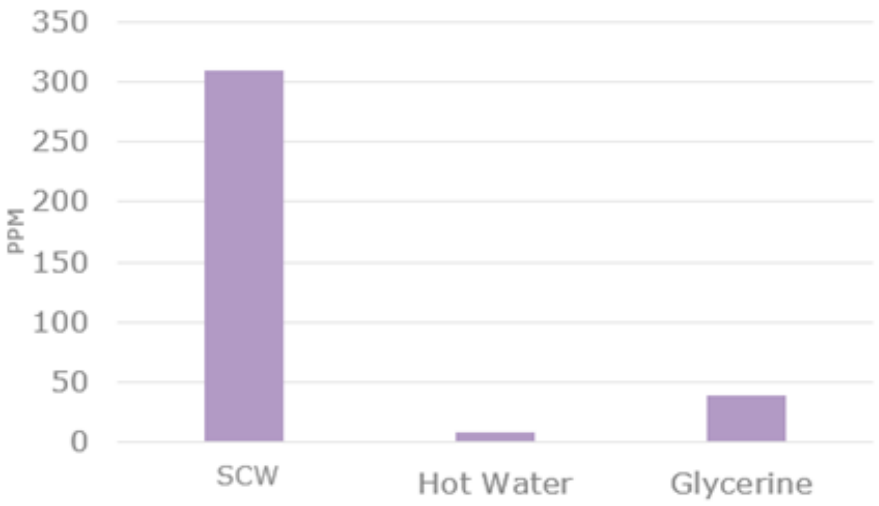

Figure 18: Comparison of the caffeoylquinic acid derivatives extracted from Stevia rebaudiana.

158% more using the SCW technique than the hot water or aqueous glycerin, respectively, while hot water was able to extract 63% more than aqueous glycerin. Extracting 161% more oleuropein with SCW than hot water and 53% more than aqueous glycerin, the SCW technology captures the capabilities of both solvents in one process. The aqueous glycerin extracted 15% more apigenin than the SCW Extract, but SCW extracted 151% more than the hot water. Aqueous glycerin extracted 157% more than the hot water extraction as well.

The sum of the three compounds highlights the ability of the SCW technology to extract more active compounds from Ligustrum than other extraction techniques (Figure 17). The SCW technology extracted 8 times and 3 times more arginase compounds than the hot water and aqueous glycerin extractions.

Stevia is well known for its low-calorie SCW Extract et flavour in the food industry due to its steviol glycoside composition. These compounds taste SCW Extract et, but do not contain the same calorie density found in sucrose only SCW Extract. Additional compounds that are of interest are caffeoylquinic acid derivatives, including 3,5-caffeoylquinic acid, 4-caffeoylquinic acid, 4,5-di-o-caffeoylquinic acid and 3,4-di-o-caffeoylquinic acid. The steviol glycosides and caffeoylquinic acid derivatives may contribute to the retinoid-like mechanism of action found in the Stevia rebaudiana leaf/stem extract ingredient. While steviol glycosides have skin benefits, their content in Stevia extracts is well known, so a focus on the caffeoylquinic acid derivatives highlights unique compounds SCW was able to extract and illustrate the unique compounds that contribute to the Stevia rebaudiana leaf/stem extract ingredient.

Analysis of the individual caffeoylquinic acid derivatives in the Stevia extracts, demonstrates that these compounds are not well solubilized in water and aqueous glycerin (Figure 18). Steric hindrance may contribute the decrease in extraction of the

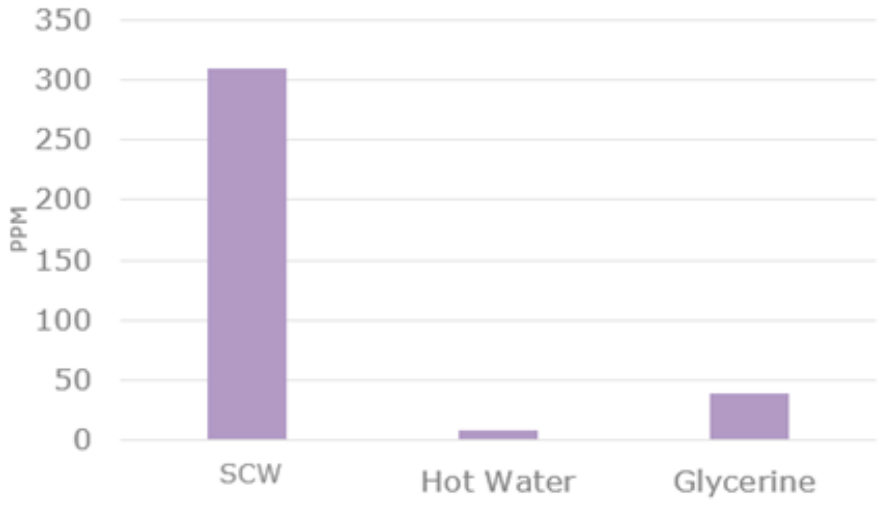

Figure 19: Comparison of the total caffeoylquinic acid derivatives extracted from Stevia rebaudiana.

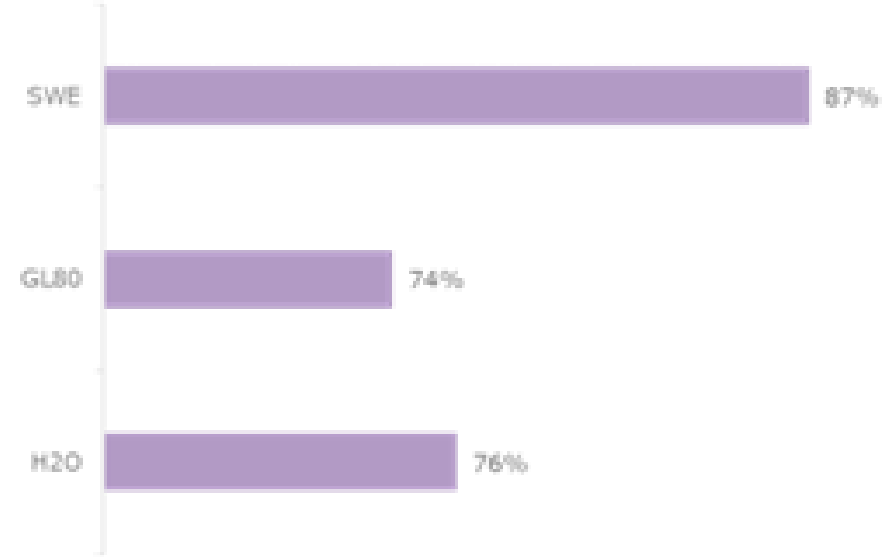

Figure 20: Comparison of the number of compounds extracted from Myrothamnus flabellifolius by different methods.

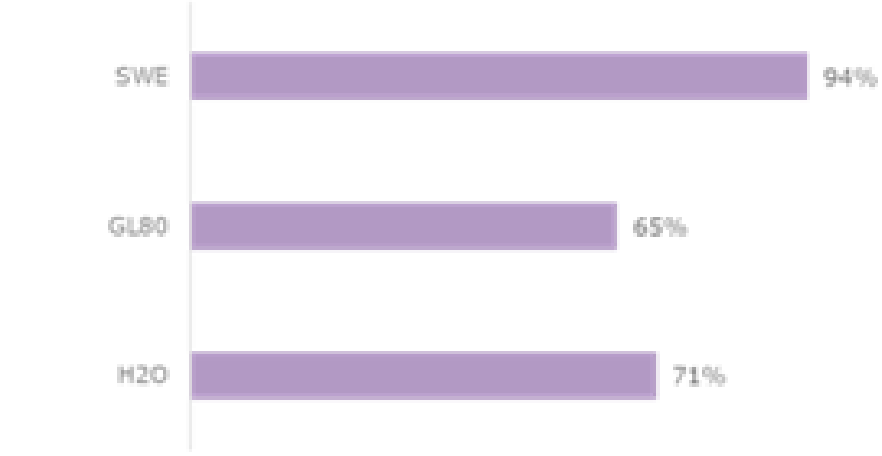

Figure 21: Comparison of the number of compounds extracted from Ligustrum lucidum by different methods.

caffeoylquinic acid derivatives with the larger branched compounds extracting less with the hot water and aqueous glycerin techniques. Extracting the 3,4-di-o-caffeoylquinic acid compound highlights the ability of SCW to better extract less polar compounds than hot water and aqueous glycerin, specifically 199% and 176% more. The 4,5-di-o-caffeoylquinic acid, had similar results with SCW Extract having 199% and 179% more than the hot water and aqueous glycerin extracts, respectively. The SCW Extract extracted 157% more than the aqueous glycerin and 194% more than the hot water extraction for the 4-caffeoylquinic acid. The difference in 3,5-caffeoylquinic acid extracted using the SCW technology is 197% greater than the hot water and 150% greater than the aqueous glycerin extraction techniques. From this data, hot water alone is not able to extract caffeoylquinic acid derivatives from Stevia and aqueous glycerin is not able to extract amounts that would contribute to activity in the extract from these compounds.

Evaluating the sum of these caffeoylquinic acid derivatives identified in the Stevia extracts, shows how the SCW can be used to extract a more complex range of compounds compared to traditional techniques. Using aqueous glycerin allows over 160% extraction of these compounds combined compared to hot water and SCW Extract is about 197% greater than the hot water extract. Stevia extracts made with SCW contain 7 times as much caffeoylquinic acid derivatives as aqueous glycerin extracts and 27 times as much as hot water extracts (Figure 19).

4.4 Phenolic phytoactive extraction performance

The extraction performance of the different techniques was evaluated by summing the total number of individual phenolic compounds greater than or equal to 0.1 ppm identified by LC-MS/MS in each extract and dividing by the total number of compounds identified across all extracts.

It was determined Myrothamnus

flabellifolius contains 38 individual phenolic compounds. The aqueous glycerin extraction recovered 74% of compounds and hot water recovered 76% of compounds, while the SCW Extract recovered 87% of compounds (Figure 20). The greater number of phytoactive compounds extracted from Myrothamnus flabellifolius by SCW compared to hot water extraction and aqueous glycerin extraction, demonstrated the efficiency of the SCW extraction technology.

There were 17 individual compounds identified in the Ligustrum lucidum extracts. SCW extracted 94% of the total number of compounds identified, while hot water extracted 71% of compounds and the aqueous glycerin extract had only 65% recovered (Figure 21). Again, the SCW technology recovered more phytoactives from the Ligustrum botanical material, making the Ligustrum lucidum seed extract ingredient a more complex extract than other traditional techniques.

Stevia contained 43 individual compounds in the analysed extractions. The hot water extraction recovered only 67% of the compounds identified. Aqueous glycerin and SCW extractions recovered 79% and 86%, respectively (Figure 22). The greater number of compounds extracted into the Stevia rebaudiana leaf/stem extract ingredient contribute to it phytoactive properties.

Extractions made with SCW contained on average 18% more compounds than the hot water extractions and 16% more than the aqueous glycerin extractions in these three botanical examples. The additional compounds allow extractions made with SCW to have increased phytoactive capabilities and differentiates them from traditional extraction techniques.

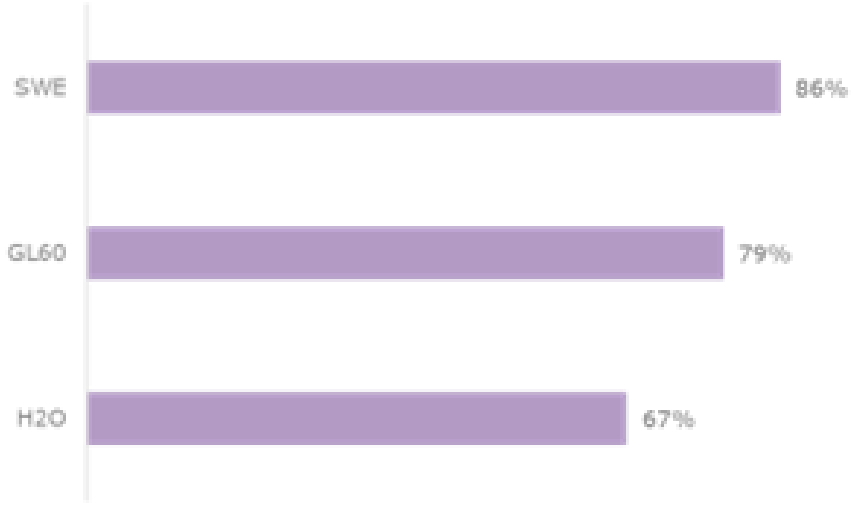

Figure 22: Comparison of the number of compounds extracted from Stevia rebaudiana by different methods.

5.0 Conclusion

SCW extraction technology is the perfect ecofriendly extraction technique for highly potent phytoactives, with many advantages over traditional extraction techniques. The technique has a short extraction time, requires no use of chemical solvents with the ability to extract a high concentration and a broad range of phytoactives as well as extract poorly water soluble phytoactives. All of this can be achieved without appreciable thermal degradation in a pure, sustainable, eco-conscious manner, aligning with the market requirements. In the case studies we have demonstrated that the use of SCW extraction was a far superior method vs the other extraction techniques, with a greater amount and a broader range of phytoactive compounds extracted from botanicals through subcritical water, compared to the other methods. This illustrates the ability of the SCW extraction technology to recover a more complex extract from botanical materials, creating unique advanced botanical ingredients.

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WINNER – EDUCATION AWARD

Sustainability is more than just refillable or reusable packaging!

Bree Webster, Director of Activ-Ingredient Pty Ltd

Sustainability is not a fad, it is a global movement, and it is much more than the "blue beauty trend", which is the collection of single-use plastic from the ocean and recycling it into new packaging. It goes beyond vegan, reef-friendly, and cruelty-free, to name a few buzzwords. And if you think that just because you choose to use only natural ingredients within your formulation puts you ahead of the sustainability curve, it might benefit your brand to have a deeper review. To avoid a greenwashing scandal, you should have proof of the brand's claims.

You can't tell me there wasn't a business owner not taking another look at their marketing messages when the ACCC announced: "Not one, but two internet sweeps would be taking place to identify misleading environmental and sustainability marketing claims and fake or misleading online business reviews", the cosmetics industry included.[1] 'Of the 247 businesses reviewed during the sweep, 57% were identified as having made concerning claims about their environmental credentials. The cosmetic, clothing & footwear and food & drink sectors were found to have the highest proportion of concerning claims.'[14]

Figure 1: 17 United Nations Sustainable Development goals [3]

New questions should be added to your brand's formulation brief to substantiate your sustainability claims better. So, let's start with a high-level review of two critical resources for sustainability to drive the questions you need to ask your ingredient manufacturers.

'In 2015, the United Nations Environment Program published its

Blueprint for Business Leadership on the United Nations Sustainable Development Goals (UN SDG), guiding at three levels: global, local, and people action.[2] The responsibility of building a sustainable planet is a common goal for everyone, every company and every country. They are great building blocks for your company to develop its' sustainability objectives (figure 1)[3].

Let's review goal #7, figure 1: affordable and clean energy.

Can your business look to use more renewable energy with the installation of solar panels? An Australian energy provider states that adding a 99.22kW solar system generates approximately 143MWh of clean, renewable energy annually. This is enough to power approximately 28 homes and reduces the business's CO2 emissions by 76 tons annually.

Which of these UN SDG goals will your business be able to implement? Embracing some of these goals will help with your Corporate Social Responsibility (CSR) policy, which I will cover in more detail later.

Furthermore, in 1998, Paul Anastas and John Warner (figure 2) developed the 12 principles of green chemistry.[5] The manufacturers of your ingredients will be aware of these principles and would have been applying them for some time when creating new cosmetic ingredients; see figure 2.[6] There are several great videos on YouTube for your viewing pleasure to help you better understand the importance of each principle.

I want like to build your understanding of why these are important by highlighting a few in further detail.

Principle #2: Atom Economy:

We have all heard several upcycling stories in the cosmetics industry in the past year. Upcycling is where a fruit or vegetable component is usually discarded, for example, from a juicing manufacturer, maybe heading straight for disposal. Recently the cosmetic industry has been collecting such industry waste

Figure 2: The 12 Principles of Green Chemistry [5]

and treating it in various ways to produce cosmetic ingredients, thereby reducing another industry's atom economy equation.

Principle #7: Use Renewable Feedstocks.

Renewable means it can be replenished on a human timescale, unlike fossil fuel, e.g., Petrolatum. Hence the need to create petrolatum alternatives with various mixtures of natural waxes, emollients and extracts (e.g. shea butter and its derivatives); these natural-based ingredients are renewable and sustainable.

This leads me to ask if it is more responsible utilising ingredients from certified sustainable farming practices, e.g., RSPO palm oil. Or are the same sustainable principles being applied if we choose to go down the palm-free route? Have you considered the renewable and sustainable farming practices of the alternatives?

Principle #10: Design for Degradation.

Biodegradation is the degradation of materials into environmentally acceptable products such as water, carbon dioxide, and biomass by the action of naturally available microorganisms under normal environmental conditions.[13]

"A biodegradability assessment is the key feature for ensuring the removal of organic substances from the environment. An ingredient is determined as biodegradable if it is measured as 'readily biodegradable' in a test conducted following OECD guidelines or equivalent"[7] [8]

An example would be when the cosmetics industry pushed to remove all microplastic used for exfoliation in all formulations as they are not readily biodegradable. Those offering sharp crushed apricot shells for exfoliation rather than tiny plastic symmetric beads were ahead of the times. We have seen this evolve again, most recently with natural cellulose, an organic and natural polymer used as the new exfoliant of choice.

You can review the biodegradable information on the SDS, Section 12

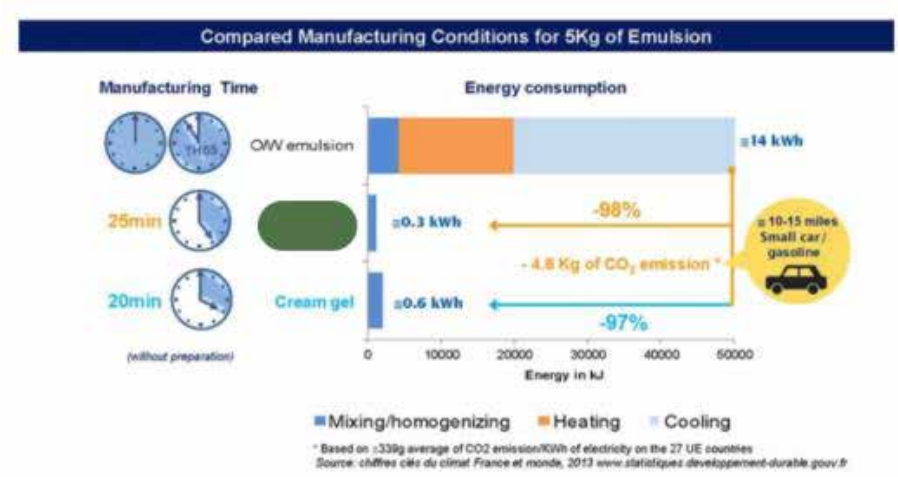

Figure 3 Cold Emulsion [11]

Ecological Information: 'This section outlines the material's effects on the surrounding environment if released. Information regarding; ecotoxicity, bioaccumulate potential, and other adverse effects.'[9]

With the rise in biotechnology and fermentation manufacturing, will this evolve the consumer's thirst for more science-created ingredients rather than community farming? This type of manufacturing "uses little to no land usage, preserves biodiversity, uses no toxic solvents, reduced water consumption and generates little waste". [2]

Some companies will find it very challenging to meet all of the 12 principles of green chemistry with current manufacturing processes when creating new ingredients; new technology is the key to a successful, more sustainable future.

So, I believe we now have a few more questions for our brand's ingredient brief:

- Derived from renewable raw materials or biotechnological processes, e.g. fermentation
- Does the ingredient support a more circular economy, e.g. upcycling
- Biodegradable? some materials will have a greener manufacturing process, and current manufacturing may not provide an alternative that is 100% biodegradable.

We now know that cosmetic consumers are looking at sustainability with a broader lens; this means they also review the company's CSR policy.

'Corporate Social Responsibility is a management concept whereby companies integrate social and environmental concerns into their business operations and stakeholder interactions. CSR is generally understood as how a company balances economic, environmental, and social imperatives.'[10]

CSR policy details for larger companies could be located on their website; they may even share stories with you to help the promotion of a more sustainable ingredient. Some might call it "a three-tiered approach. We work in the same holistic way across all our supply chains to identify risks and find solutions that protect biodiversity and ecosystems, improve smallholder livelihoods, and safeguard labour and human rights."[11]

So, I believe we now have another question for our brand's ingredient brief:

- What is the CSR policy for the manufacturer of your chosen ingredient?

You might be thinking, shouldn't sustainability have a certification you can request, and if so, which one? Just like organics certification, a few are emerging in the market. This is not an exhaustive list, but just a few that popped up in my search: Sustainable Business Network; B Corp; EcoVadis; natrue.org cosmos-standard.org; CarbonNeutral.com.au; climate neutral.org; c2ccertified.org; demeter.net; and the list goes on. You may even have read many articles

from provenance.org; they work with brands to turn positive social and environmental impacts into brand value.

I hope you are preparing to write down your next question for your brand's formulation brief.

- What sustainability certifications do your major manufacturers have in place already?

We will now shift focus to consider the manufacturing process of your cosmetic formulation. As you will all know, going from lab scale to full production can mean more processing time and energy than expected. Has your brand considered reviewing your current procedures to be more energy efficient? For example, you might wish to hydrate your polymer in the water phase the night before to allow for complete hydration with almost zero energy expenditure.

Is it time to review your long-standing polymers and emulsifiers of choice, your pantry staples, to take small steps toward the brand sustainability's goals? Manufacturers now offer ingredients that require less energy to process, e.g., homogenise at ambient temperatures or more concentrated ingredients, with higher performance therefore, lower percentage inclusion.

Yes, you guessed it; the following questions should be added to your brand's formulation brief: How energy efficient is this ingredient? Is it hot or cold processable? Does it require a longer processing time than other ingredients?

The new generation of polymers and emulsifiers on the market will give you a more carbon-friendly manufacturing process. You may need to consider some synthetic ingredients to reduce your carbon footprint. Figure 3.[12]

I want to leave you with one last consideration: packaging; however, not the version your consumer is left to recycle or reuse, but the packaging that ingredients are delivered in. Do you have a plan for the responsible disposal of the jerricans, steel drums, bags, or pails? You might even ask for alternative packaging options from the manufacturer to accommodate your current disposal processes.

In conclusion, this article aims to ensure you are equipped with a few additional questions to include in your brand's formulation brief to assist in

choosing more sustainable ingredients. These essential questions are small steps to take a giant leap towards a more sustainable future.

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