

Preparation of Topical Cream for the Potential Treatment of Atopic Dermatitis



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Acknowledgment: National Institute for Health and Care Research (NIHR) for their funding, UURIP admin team for their support and Dr Colin Michie for his continual guidance.

INTRODUCTION

Atopic dermatitis (AD) is a chronic, itchy, and inflammatory skin condition, characterised by episodic flare-ups and driven by a combination of genetic predisposition, skin barrier dysfunction, environmental triggers, and immune dysregulation.¹ Biomolecule A has been identified through literature review as a potential active ingredient for repairing the compromised skin barrier, a key feature of AD.

MATERIAL & METHOD

Formulations were prepared by adjusting proportions of Olivem 1000, almond oil, Lipid Dimodan U/J, and water, and categorised as **stable**, **too watery**, **too thick**, or **phase-separated**. 3 stable formulations with maximum water content were chosen and prepared in two versions: a vehicle cream (control) and one loaded with Biomolecule A to assess its impact on formulation properties. 6 formulations below were then further charaterised.

Table 1. Formulations Detail

Sample	Olivem 1000 (%)	Almond Oil (%)	Dimodan U/J (%)	Distilled Water (%)	Contains 4% Biomolecule A in Distilled Water
X1	10	5	0	85	X
X2	10	5	0	85	✓
Y1	10	0	0	90	X
Y2	10	0	0	90	✓
Z1	7.5	2.5	5	85	X
Z2	7.5	2.5	5	85	✓

VISCOSITY

It was measured using a ViscoQC 300-R viscometer with a CP52 spindle at 10.0 rpm and a constant temperature of 25.0°C for 30 seconds.

SPREADABILITY

Each formulation (0.25 g) was spread into a 1 cm diameter circle, pressed with a 396.82 g weight for 2 minutes. The final diameter was averaged from three trials per formulation.

SMALL ANGLE (SAXS) AND WIDE ANGLE X-RAY SCATTERING (WAXS)

Each formulation was loaded into a 2 mm capillary and analysed using a Nano-inXider SAXS/WAXS instrument at high resolution, with 300-second exposure times at 20°C and 37°C.

DIFFERENTIAL SCANNING CALORIMETER (DSC)

TA Instruments Q200 Differential Scanning Calorimeter with an aluminum pan was used. The sample was ramped to 10°C, then heated to 80°C at a rate of 4°C per minute.

OBJECTIVE

This study focuses on formulating and characterising Biomolecule A in various cream formulations to assess its efficacy in addressing skin barrier dysfunction, a critical factor in AD.

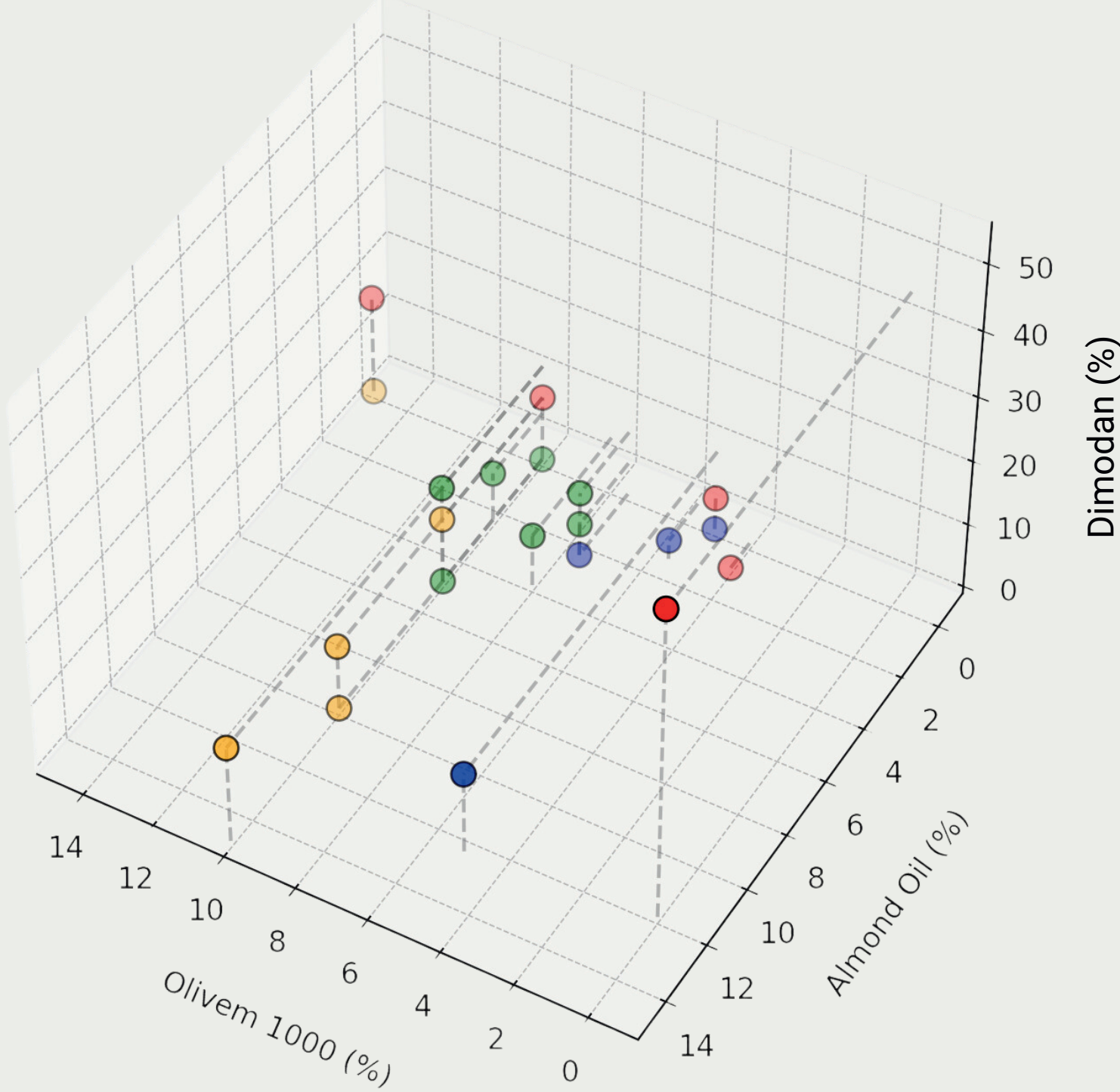


Fig 1. Phase Diagram of Olivem 1000 (%) versus Almond Oil (%) versus Dimodan (%)

RELEASE STUDY

Each 500 mg formulation was placed in a pre-soaked dialysis bag, securely tied, and submerged in a 200 mL beaker of distilled water. The beakers were heated at 37°C in a shaking water bath, with samples collected at specific intervals and analysed by UV spectrophotometry.

OCCLUSIVITY

5 g of distilled water was placed in a 20 ml vial, sealed with Whatman filter paper (Cat No. 1001-125), and 100 mg of the sample was evenly distributed on top. The vials were stored at room temperature for 24 hours. The occlusion factor F was then calculated.

Where,

A= The weight difference of the negative control

B= The weight difference of each formulations

$$F = \frac{(A - B)}{A} \times 100$$

RESULT AND DISCUSSION

OBSERVATION

All creams were initially white and mildly translucent. Formulations with Almond Oil showed better consistency, while those with Dimodan U/J had a worse odor. Formulations with Biomolecule A turned bright yellow after high-heat preparation and overnight storage, while low-heat preparations remained unchanged when exposed to light or air. No changes occurred in controls.

VISCOSITY

Results showed reduced viscosity when Biomolecule A was added, with formulations containing Dimodan U/J being the least viscous. See graph 1 for detailed result.

Graph 2. Paired Comparison of Diameter between Formulations

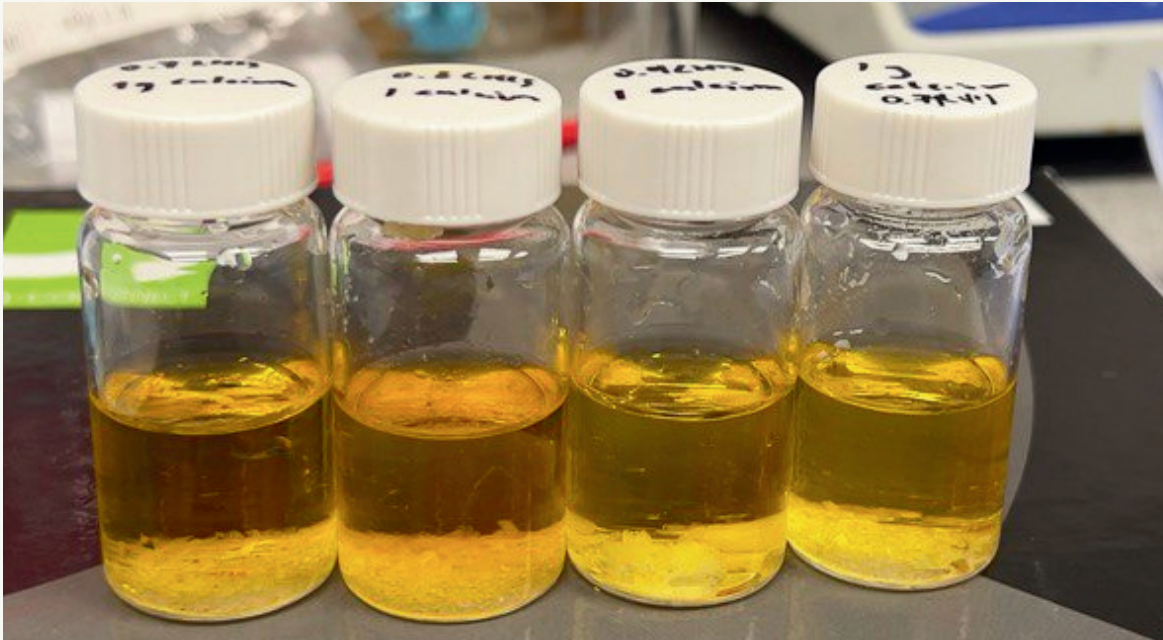
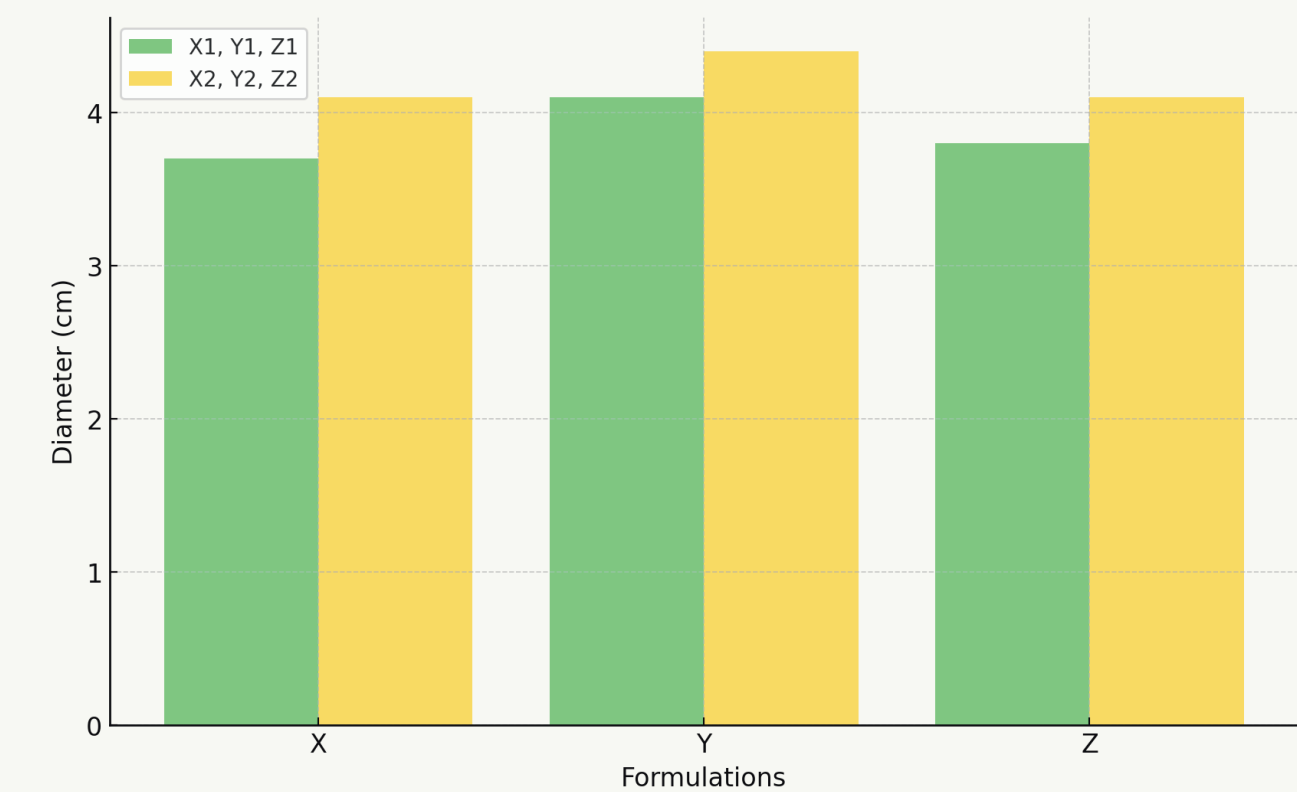
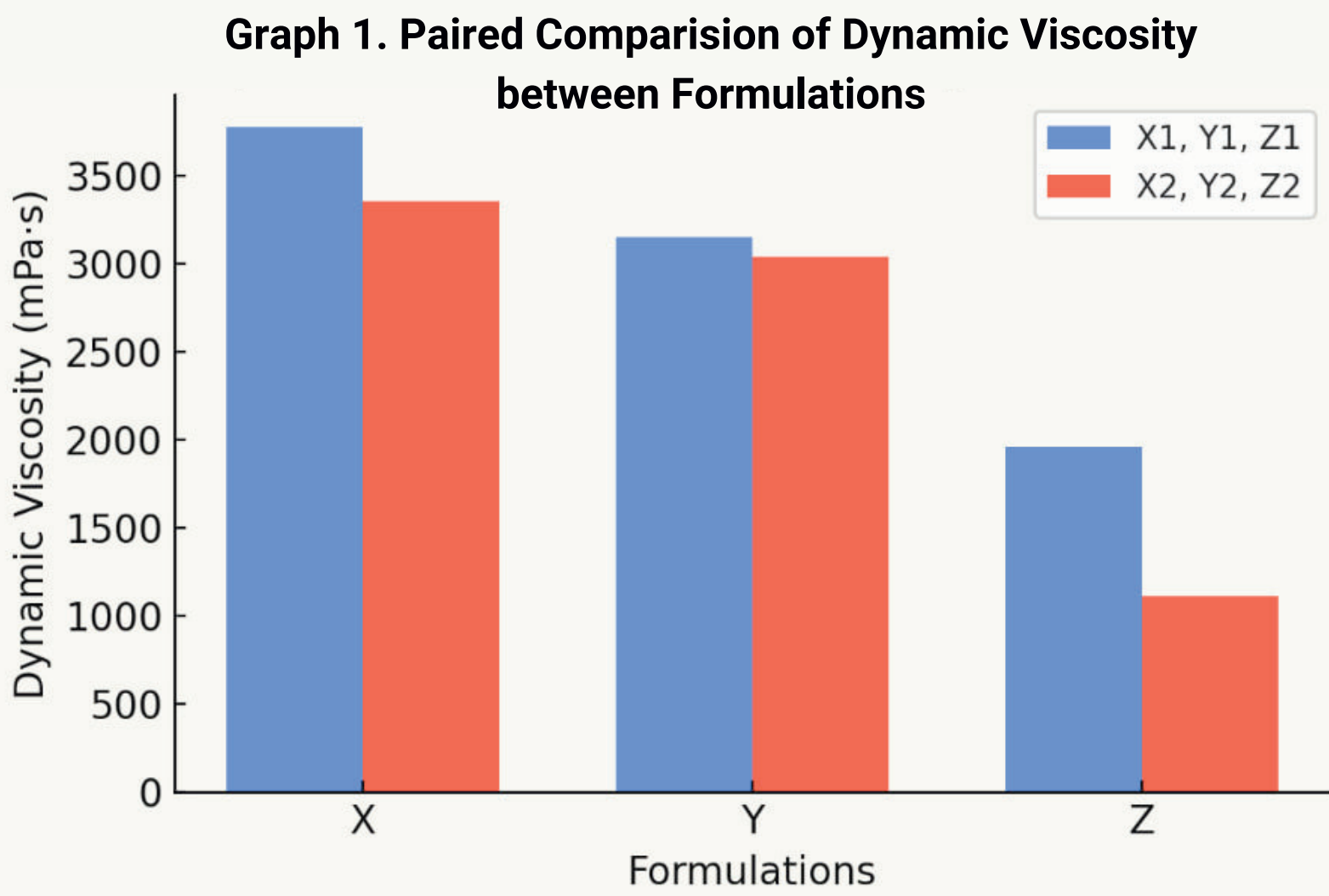


Fig 2. Biomolecule A Solution after 1 week



Fig 3. Left: without Biomolecule A; Right: with Biomolecule A



SPREADABILITY

Spreadability improved in all formulations with Biomolecule A, with consistent results across formulations. See graph 2 for detailed result.

OCCLUSIVITY

Occlusivity decreased in formulations with Biomolecule A, but those containing Dimodan U/J maintained the highest occlusion factor.

RELEASE STUDY

The release study yielded inconclusive results, as the findings were similar to the controls. This may be due to the low absorbance caused by the transparency of the Biomolecule A solution.

SAXS & WAXS

X-ray scattering revealed that Olivem 1000 forms a lamellar phase, while Biomolecule A self-assembled into nanostructures, suggesting potential for enhanced delivery. However, further testing is needed to confirm these findings.

Graph 4: Comparison of SAXS & WAXS Result of Each Formulation

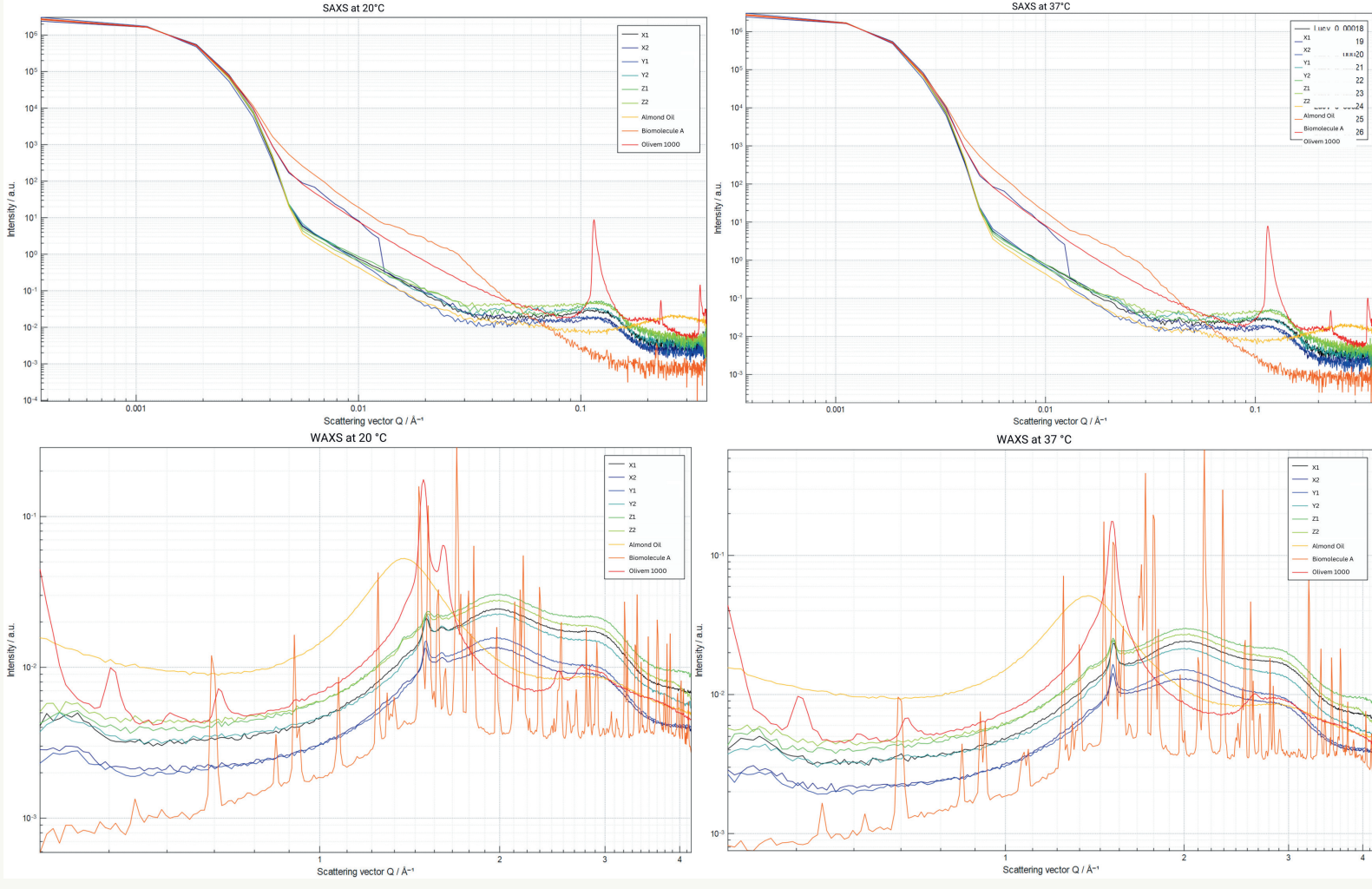
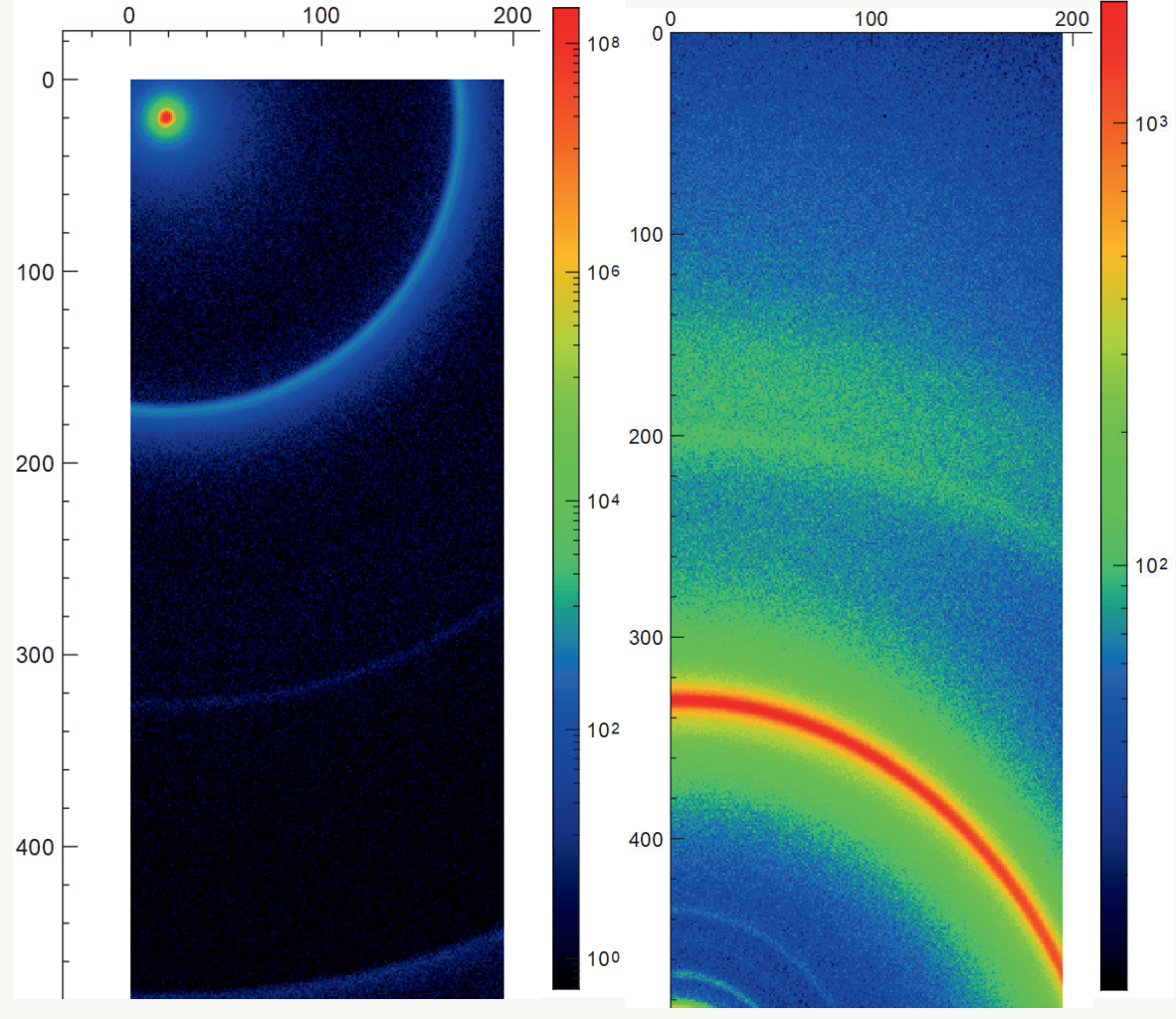


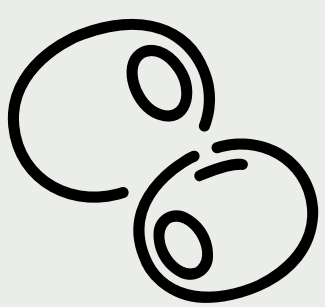
Fig 4. Olivem 1000 SAXS and WAXS



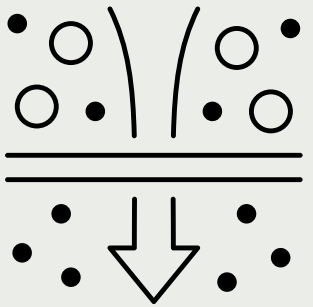
DSC

Phase transitions were observed in all formulations, ranging from 40°C to 65°C. The formulation with only Olivem 1000 and distilled water had the highest melting point, while formulations with Dimodan U/J had the lowest. The presence of Biomolecule A increased the melting point of the formulations.

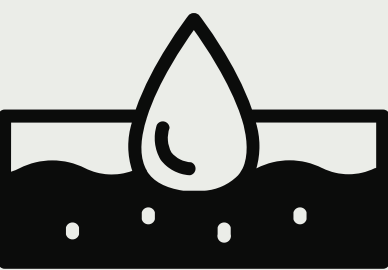
CONCLUSION AND FUTURE DIRECTION



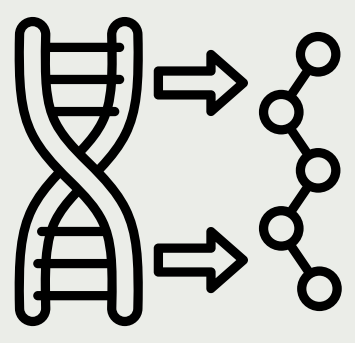
Olivem 1000 is an effective emulsifier for high-water-content creams



The release of Biomolecule A need to be analysed using High-Performance Liquid Chromatography (HPLC)



Transdermal delivery will assessed with Franz diffusion cells



Gene expression will be assessed on human cell cultures