

Waterless Beauty: Development of Anhydrous Makeup Removers in Different Product Formats with Polyurethane-based Oil Thickener

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Introduction:

Waterless formulations are paving the way for sustainability, with rising global concerns over clean water supplies and shortages. In the present market, the most common anhydrous makeup remover exists in the form of low viscosity cleansing oil, and there is a lack of variety in product formats due to limited selection of associative oil thickeners available. Therefore, a rheology modifier that is able to thicken oil is needed to address the current market gap. Polyurethane-79 (Fig-1) was selected in this study as the main structurant and rheology modifier to provide high clarity, thickening and suspending properties.

The goal of this study is to develop a range of anhydrous makeup remover product formats to address the market needs by focusing on Polyurethane-79 as the key rheology modifier.

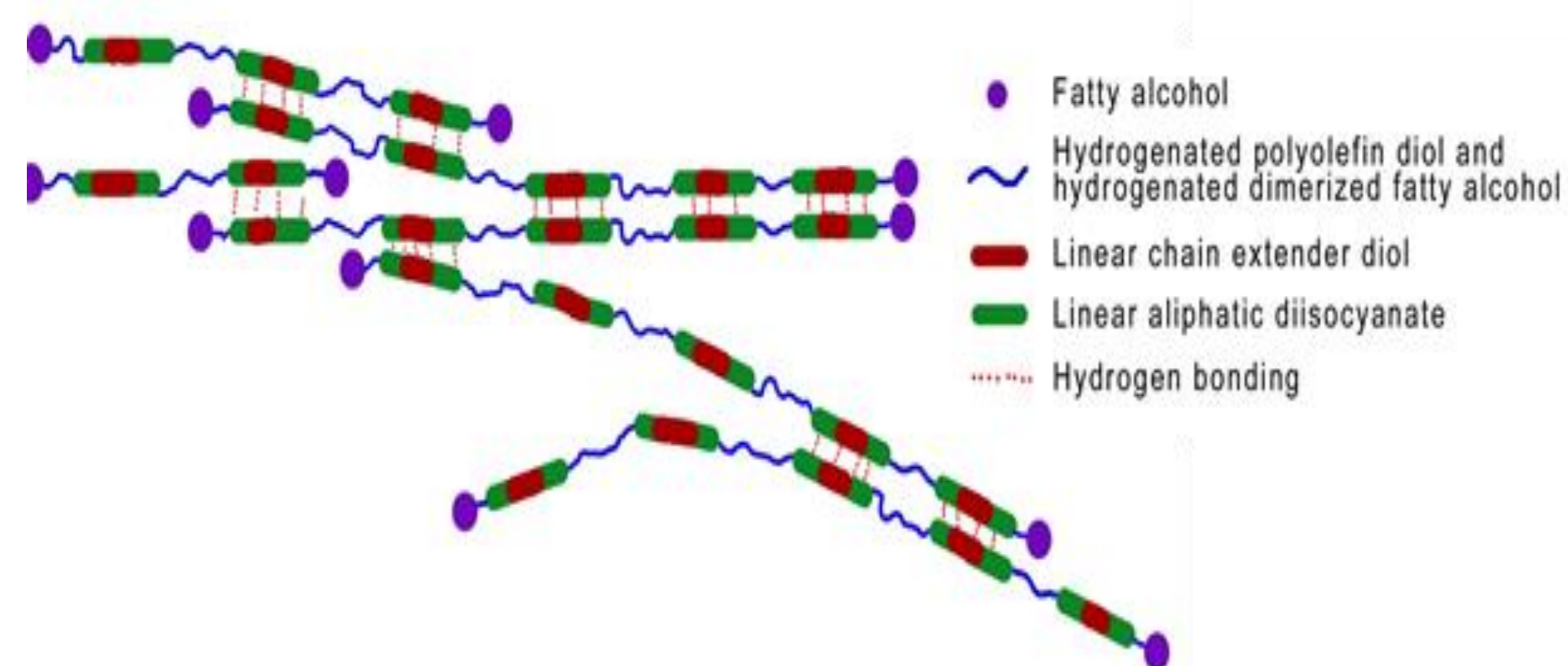


Fig-1. General structure of Polyurethane-79 [1]

Materials & Methods:

Table-1 details the different product formats that can be achieved with Polyurethane-79 by varying the dosage and oil selection. All ingredients were weighed and added into a suitable beaker and heated to 90°C while stirring at 300rpm. The samples were then filled into glass bottle containers and cooled to room temperature.






Table-1 Formulations of different anhydrous makeup remover formats

INCI	Weight% Formula 1	Weight% Formula 2	Weight% Formula 3	Weight% Formula 4	Weight% Formula 5
Cocoyl Adipic Acid/Trimethylolpropane Copolymer	43.50	43.50	30.00	42.20	24.00
Neopentyl Glycol Diethylhexanoate	35.00	35.00	20.00	35.00	10.00
Isopropyl Isostearate			21.00		
Isostearyl Isostearate					15.00
Caprylic/Capric Triglycerides and Polyurethane-79	0.00	0.50	3.00	3.00	35.00
PEG-3 Glyceryl Cocoate	7.50	7.50	7.50	7.50	5.00
Oleth-10	7.50	7.50	7.50	7.50	
Methyl Glucose Dioleate	1.00	1.00	1.00	1.00	1.50
PEG/PPG-8/3 Laurate	5.00	5.00	10.00	5.00	10.00

To evaluate makeup removing efficacy of the formulations, color measurement of the artificial skin was performed at five different points. Δ E value was calculated, which represents the color difference between the clean artificial skin and the artificial skin after makeup removal.

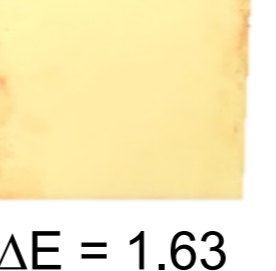
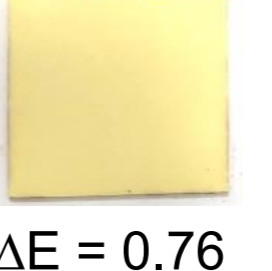
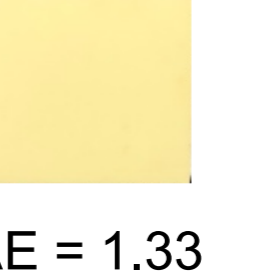
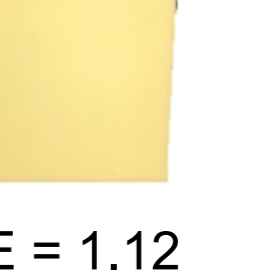
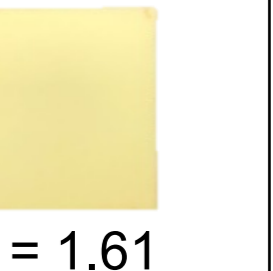
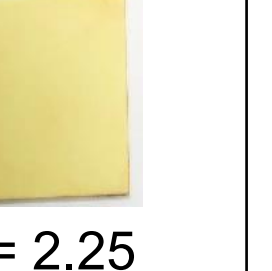
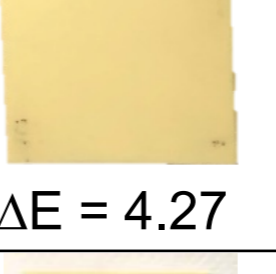
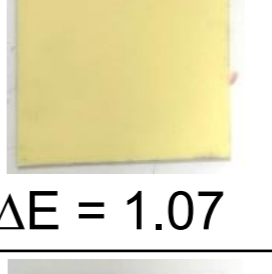
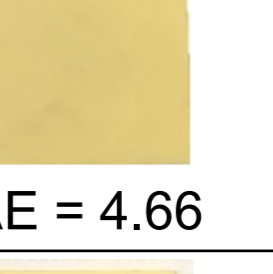
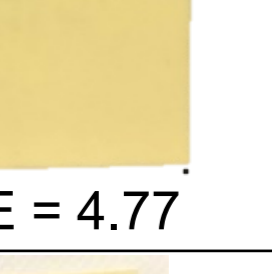
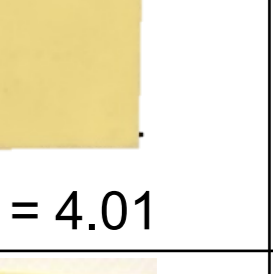
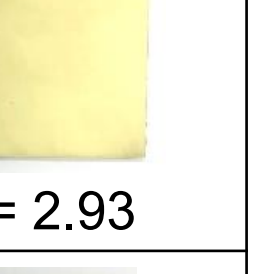
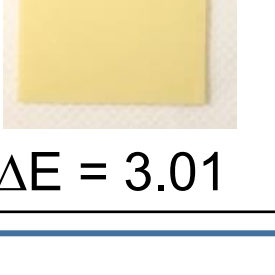
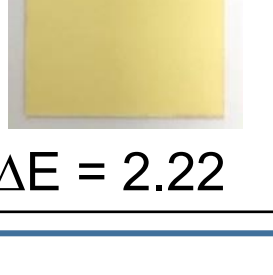
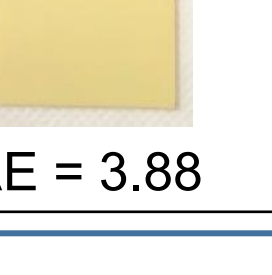
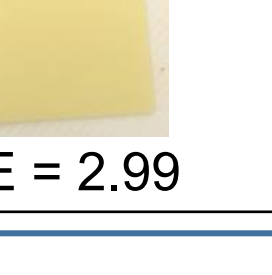
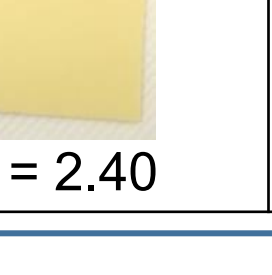
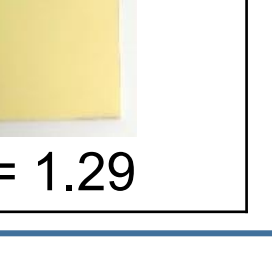
Results & Discussion:

Table-2 Physical properties of different anhydrous makeup remover formulations

Physical properties	Formula 1	Formula 2	Formula 3	Formula 4	Formula 5
Appearance					
Viscosity (mPa.S)	(Water-thin)	675	5340	(solid)	(solid)
Turbidity (NTU)	3.10	2.00	8.61	6.32	56.2

Formula 1 and 2 are low viscosity clear cleansing oils, however, Formula 2 contains Polyurethane-79, which allows for beads suspension. Formula 3 is an oil gel that can be dispensed from a tube for easy application. Formula 4 is a clear solid balm that melts into an oil during spreading and turns into a milky emulsion when in contact with water. Formula 5 is a translucent stick that is suited for removing makeup on the go and does not require rinsing in the makeup removal process.

Table-3 Makeup removing efficacy of different anhydrous makeup removers

	Commercial Cleansing Oil	Formula 1	Formula 2	Formula 3	Formula 4	Formula 5
Foundation	 ΔE = 1.63	 ΔE = 0.76	 ΔE = 1.33	 ΔE = 1.12	 ΔE = 1.61	 ΔE = 2.25
Eyliner	 ΔE = 4.27	 ΔE = 1.07	 ΔE = 4.66	 ΔE = 4.77	 ΔE = 4.01	 ΔE = 2.93
Lipstick	 ΔE = 3.01	 ΔE = 2.22	 ΔE = 3.88	 ΔE = 2.99	 ΔE = 2.40	 ΔE = 1.29

Conclusions:

By varying the use level of Polyurethane-79, a variety of textures was achieved, ranging from low viscosity oils with suspension capability, to solid stick applications, which demonstrated the versatility of Polyurethane-79 as an oil thickener.

All the formulations have similar makeup removing efficacy to commercial cleansing oil, and the high efficacy would mean that consumers do not have to tug away at their skin in order to remove their makeup, which makes them gentle on the skin.

Despite being oil-based systems, all the formulas have excellent rinseability, and doesn't leave behind unpleasant, greasy residue. Hence, a double cleanse will not be necessary as the skin is left feeling clean and soft after rinse, and this will enable consumers to simplify their beauty routine.

Acknowledgements:

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References:

1) Birjandi Nejad, H., Paczkowski, M. A., Malajati, Y., & Melkowits, R. B. (2018). Polyurethane rheology modifiers for organic compositions. Journal of Applied Polymer Science, 135(25), 46372