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**Phase Behaviors of Polyphenols from Olive Mill Waste
Water and Olive Leaf Extract**

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Phase behaviors of polyphenols from olive mill waste water
and olive leaf extract

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Dedication

I would like to dedicate my thesis to my beloved parents for their support and encouragement...to my great teachers...to my friends...

Nour Qashqish

Declaration

I certify that this thesis submitted for the degree of Master, is the result of my own research, except where otherwise acknowledged, and that this thesis (or any part of the same) has not been submitted for higher degree to any other university or institution.

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Abstract

This study aims to formulate environmentally friendly microemulsion using polyphenols extracts from olive mill waste water and olive leaves and new type of surfactant which is called extended surfactants. These types of the surfactants are produced to increase the interaction on the oil side of the interface up to level that the formation of microemulsion is presently possible with triglyceride oils, or hydrocarbon oils. The anionic extended surfactant in this study is linear alkyl alkoxy sulfate sodium salt (X-AES, $C_{12}H_{25}-(PO)_{14}-(EO)_2-SO_4Na$). The oil phases are olive oil and isopropyl myristate. And polyphenols that have been extracted from olive mill waste water and olive leaves were used as the aqueous phase.

This study also aims to show the effect of sodium chloride (NaCl) salt on the phase behavior using "Fish Cut Phase Diagram" at water / oil ratio equal 1:1.

At first, we investigated the effect of using polyphenols extract from olive mill waste water on the phase behavior of olive oil / polyphenols in olive mill waste water / linear alkyl alkoxy sulfate sodium salt and isopropyl myristate / polyphenols in olive mill waste water / linear alkyl alkoxy sulfate sodium salt. Then, we investigated the effect of using olive leave extract on the phase behavior of olive oil / olive leaves extract / linear alkyl alkoxy sulfate sodium salt and isopropyl myristate / olive leaves extract / linear alkyl alkoxy sulfate sodium salt. Then we investigated the effect of using olive mill waste water as oil phase on the phase behavior of olive mill waste water / milli Q water / linear alkyl alkoxy sulfate sodium salt. The previous phase behaviors were studied using ternary phase diagram. Then we studied the effect of sodium chloride salt on the phase behavior of isopropyl myristate / olive leave extract / linear alkyl alkoxy sulfate sodium salt using fish phase diagram. Phase number for all samples was detected using visual inspection. Anisotropy was detected for all samples using cross polarizers. Phase diagrams were plotted using origin pro 8.

It was found that the linear alkyl alkoxy sulfate sodium salt with chemical formula $C_{12}H_{25}-(PO)_{14}-(EO)_2-SO_4Na$ plays critical role in the formation of environmentally friendly microemulsion with polyphenols that have been extracted from waste by – products olive mill waste water and olive leaves. Polyphenols compounds in olive mill waste water and olive leaves helped in the formation of microemulsion. Using ethanol as a solvent to

extract polyphenols from olive leaves and olive mill waste water helped in the formation of the microemulsion. Triglyceride oils with high molecular volume such as olive oil are difficult to solubilize in microemulsion, whereas the oils with short chain hydrocarbon such as isopropyl myristate is easier to microemulsify. From fish phase diagram normal microemulsion transition from Winsor type I to Winsor type III was observed by increasing salt concentration. Also we were able to form Winsor type IV microemulsion, which can be used in different application (like many cleaning products and washing detergency).

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