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The aim of this work is to prepare some surfactants from locally available materials as possible to be used as foaming agents in the formulations of aqueous film forming foam (AFFF). The evaluation of these surfactants on the base of stable and sealable foam performances and the ability of their application in the area of fire extinguishing in petroleum industry.

SUMMARY

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Foams have long been of great practical interest because of their widespread occurrence in everyday life. Fire fighting foams are one of these great applications of foams. They are used to combat a variety of flammable liquid fires. Application of fire fighting foams to a pool fire results in the generation of a foam on the liquid surface. There are two types of fire fighting foams, the first type based on protein (FFFP) fire fighting fluoroprotein, where they are produced from hydrolysis products of protein containing matter such as hoof meal, chicken feathers, and fish meal. The second type based on synthetically produced surfactants (AFFF) aqueous film forming foam. Both types should be in formulations.

Preparation of some surfactants from locally available materials with good foam properties that can be used as film forming foams was the first target of this work, and then making efficient formulations from these surfactants was the second one.

The undertaken surfactants have been prepared from benzene and phenol, where twelve surfactants were prepared; nine surfactants (5 nonionic and 4 anionic) based on dodecylbenzene sulfonic acid [DBSS(I-a), DBMSA(I-b), DBDSA(I-c), DBTS(I-d), DBPS(I-e), DBBS(I-f), DBMSASP(I-g), DBPSSP(I-h), and DBBSSP(I-i)], which were prepared from benzene by acylation, reduction, and sulfonation reactions, and three surfactants (1 anionic and 2 nonionic) based on dodecylphenol [DPE(II-a), DPESP(II-b),

and DPESS(II-c)] which was prepared from phenol by acylation and reduction reactions.

The surface tension γ_{CMC} at CMCs were measured, the effectiveness of the adsorption Π_{CMC}, the maximum surface excess concentration Γ_{Max}, the minimum area per molecule A_{min}, free energy of micellization ΔG_{mic}, free energy of adsorption ΔG_{ad}, were determined.

The foam properties; the 25% drainage time (DT) and the foam expansion ratio (ER) were measured. From the data obtained, it was found that DBSS(I-a), DBMSA(I-b), DBDSA(I-c), DBTS(I-d), DBPS(I-e), and DPSS(II-c) are showing the greater the 25% drainage time and the foam expansion ratio, where the 25% drainage time is dependent on the foam expansion ratio.

Form the data obtained by surface tension measurements and foam properties there were a relation between each other, where it was found that by decreasing surface tension the foam expansion ratio and 25% drainage time increase.

All of the prepared surfactants were evaluated as fire fighting foams (AFFF) individually using the sealability test, where all the successful surfactants were nonionics [DBMSA(I-b), DBDSA(I-c), DBTS(I-d), DBPS(I-e), and DPE(II-a)], but all the ionic surfactants were failed to form a stable sealing foam film.

Formulations for the surfactants DBSS(I-a), DBMSA(I-b), and DBTS(I-d) were made, and then their foam properties and sealability time were measured, and compared with a currently used fire fighting foams (AFFF) in Qarun Petroleum Company. From the data obtained It was found that, the

formulated surfactants as AFFF were better than or similar to the data obtained from the current used AFFF (blank sample).

The effect of pH on the foam properties of DBMSA(I-b) was measured, it was found that there is no effect of pH on the foam properties.

Also, the effect of NaCl solutions (electrolyte) on the foam properties of DBMSA(I-a) was measured, from the data obtained it was found that increasing of NaCl concentrations decreases the foam expansion ratio, the 25% drainage time, and the sealability time.