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STUDY OF THE AGING OF PERFLUOROCARBON EMULSIONS. INFLUENCE OF THERMIC STERILIZATION, FREEZING AND THAWING ON THE CHARACTERISTICS OF THE EMULSIONS

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Aqueous emulsions of fluorocarbons can be used as oxygen carriers in the biomedical field. The most common emulsions are prepared by high-pressure homogenization with Pluronic F-68 as surfactant (first-generation emulsions). Their poor stability with time and in the face of thermic stresses (sterilization, freezing and thawing) is one of their weaknesses, which current research aims at overcoming.

A study method has been worked out, consisting of observing the evolution of emulsions by establishing particle size histograms by continuous measurement of optical density during centrifugation. This method has been used on F-decalin and on the bis(F-alkyl)ethenes: $C_4F_9CH{=}CHC_4F_9$ (F-44E), $iC_3F_7CH{=}CHC_6F_{13}$ (F-i36E) and $C_6F_{13}CH{=}CHC_6F_{13}$ (F-66E), prepared by high-pressure homogenization and formulated at 27 vol/vol% of fluorocarbon (∿ 47 w/vol%) and 6 w/vol% of Pluronic F-68. Their stability has been observed at 25°C, 4°C and in the frozen state over a period of 15 months. The aging curves (average particle sizes ($\emptyset$) vs time (t)) show that in the F-nn'E series the stability diminishes drastically with the molecular weight, but for comparable molecular weight the F-44E emulsions are much more stable than the F-decalin ones. These curves are well represented, over the 15 months of observation, by parabolic equations of type: $\emptyset = \emptyset_0 + a_1t + a_2t^2 + a_3t^3$.

The intravascular use of these emulsions implies their sterilization. The determination of the sterility (by bacteriological tests) and of the fineness of F-44E emulsions in different conditions of temperature and sterilization times has permitted the optimization of these conditions (95°C, 40 min.). Since freezing is necessary for their conservation, F-44E/Pluronic F-68 emulsions have undergone freezing and thawing cycles at different speed rates. These experiments have shown that the presence of a cryo-protector (1.8 w/vol% of glycerol) was necessary to avoid damaging the emulsions.