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On Drug-micelle Aggregate Formation to Facilitate Drug Delivery

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Abstract—*In recent years, great progress has been achieved for drug's targeted and controlled release via surfactant system. Surfactant systems with amphiphilic character are interesting vehicles for effective drug delivery and their ability to solubilize hydrophobic drugs in water medium is also well known. Thus, surfactants can be exploited in controlled uptake and release of drugs and other components in many biological, pharmaceutical and environmental systems.*

Sulfamethazine (SMZ), an antibacterial compound is used to treat livestock diseases and in animal feeds to promote growth. But the main limitation for SMZ as a pharmaceutical preparation is its poor solubility (in water), low bioavailability, and medium selectivity to target cells. To solve these problems, attempts have been made through micellization of the drug with surfactants. Here, we have studied the complex formation of SMZ with Sodium-dodecyl-sulfate (SDS) and Cetyl-tri-methyl-ammonium-bromide (CTAB), two well-known anionic and cationic surfactants respectively. Different bio-physical techniques like spectroscopy (UV-vis, fluorescence, infra-red etc) and isothermal titration calorimetry have been used to monitor the said complex formation quantitatively. The results obtained from UV−vis spectroscopy showed the stepwise interaction between SMZ and the surfactants (SDS and CTAB) in the free form and under the micellar condition. This was supported by the fluorescence emission spectral study. Thermodynamics of the two-step interaction was clearly revealed by calorimetric results, where two different kinds of complexation, viz., the interaction between the SMZ with free surfactant and with micelles, were taking place. This enabled an easy differentiation of the two processes, the former being exothermic in nature which is spontaneous and enthalpy-driven but the latter is endothermic, spontaneous and entropy-driven.