part:pure oil and residue:penetration of SAA tails into the oil), whereas R_{shell} describes the distance between the center of the particle and a position in the surface film, where the difference in scattering length density has its maximum. As expected, the outer radius incorporates looser-bounded SAA molecules and is substantially bigger than the hydrodynamic radius R_h, obtained by DLS. The latter is supposed to consist of the oil core and a stronger bounded SAA film, perhaps containing some solvent molecules too.

Although ME structure elucidation by SANS has been advanced by several workers (e.g., [70–73]) there are still many complications. First, the scattering length density of the attached SAA layer is usually of the value between those of adsorbed molecules comprising the layer and solvent molecules as a consequence of penetration or adsorption of solvent into the attached layer. Second, for other than hard sphere potentials, SANS data analysis, incorporating polydispersity, may not be straightforward due to complexity in the structure factor. Nevertheless, scattering techniques are valuable tools for determining the structure of colloidal systems.

36.4 DERMAL AND TRANSDERMAL DRUG DELIVERY USING MICROEMULSIONS

The barrier nature of the skin, resulting in poor permeability of drugs, has limited the dermal and transdermal delivery of several drugs [15, 16]. Several chemical and physical methods such as chemical penetration enhancers, iontophoresis, electroporation, and sonophoresis have been employed to overcome this barrier and improve the skin drug permeation [16]. However, these approaches have their own limitations such as skin irritation and sensitization by the chemical enhancers and the physical disruption by the other methods [74, 75].

In dermatopharmacy MEs are promising colloidal carriers for dermal and transdermal delivery of drugs due to their high drug-loading capacity and drug-permeation-enhancing effects. The high drug solubilization capacity of MEs is attributed to the enormous interfacial area and existence of microenvironments of different polarity within the same single-phase system [1].

Confocal laser scanning microscopy investigations revealed the involvement of paracellular, transcellular, and transfollicular pathways [76, 77] during ME-mediated percutaneous absorption of topically applied drugs. Mostly, the transepidermal routes (paracellular as well as transcellular) are the dominant skin permeation pathways for several drugs. The very low interfacial tension between the formulation and skin ensures an excellent contact to the skin surface, where the good spreading is additionally supported by the low viscosity. Hence, the formulation is capable of entering the skin easily. Due to their hydrophilic and lipophilic domains, it can be suggested that MEs are able to interact with both the lipid and the polar pathways by entering the stratum corneum (SC) via the intercellular route.

MEs are valuable vehicles for the localization (retention) of drugs within skin layers (local effects), as well as for systemic delivery [7]. The localization of drugs in the skin layer can be used for both cosmetic and therapeutic purposes. Site-specific treatment of dermatological diseases is a classical field of topical administration. A wide range of hydrophilic and lipophilic actives can be solubilized in MEs, as there are plenty of combinations of ME constituents which principally can form MEs [4]. In the case of lipophilic substances, application of conventional vehicles such as ointments often causes formation of a drug depot in SC. This phenomenon is attributed to the high affinity of these drugs to the lipophilic structure of the outermost skin layer. MEs are capable of increasing their permeation extent.

During the past several years, improving the effect of MEs on dermal drug delivery has been demonstrated in several *in vitro*, *ex vivo*, and *in vivo* studies, showing the influence of different factors on the enhancing activity. Some of the selected investigations in delivering various classes of actives, including highly lipophilic molecules such as ceramides (CERs) and highly hydrophilic molecules such as peptides, are discussed next.