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Supplementary file 1

Table S1. Different lipid vesicular delivery systems mainly employed for the delivery of tranexamic acid and other hypo-pigmenting agents with their corresponding outcomes.

Vesicular Carrier	Encapsulated bioactive agents	Resulting Outcomes	Reference
Liposomes	Tranexamic acid	- High percentage of drug entrapment (>90%) and increase of physical stability - Reduced erythema index and enhanced moisturizing effects - Significant (>50%) reduced in mMASI scores for melasma as compared to traditional hydroquinone - Enhanced specific drug targeting ability	94-98
Ethosomes/Transethosomes	Tranexamic acid, Linoleic acid, Kojic acid di-palmitate	- Enhanced inhibition of vascularization and angiogenesis as compared to non-liposomal control - Improved drug stability at extreme temperatures - Extended performance on skin lightening and moisturizing capability - Enhanced penetration precisely to the SC depth thereby higher drug release (>95%)	29,111,113-114
Niosomes	N-acetyl glucosamine, Hydroquinone, Kojic acid, Quercetin, Rice bran bioactive compounds, Tranexamic acid	- Enhanced skin penetration as compared to drug's solution form with better depigmentation effects - Increased in drug chemical stability and percentage entrapment efficiency (>90%) - Higher susceptibility to cell toxicity (≥80% viability) - Enhanced clinical effectiveness in hydration, pigmentation, skin elasticity and texture	131-135,138
Transferosomes	Ascorbic palmitate, Niacinamide	- Enhanced 14.1-fold whitening and anti-melasma efficacy - Achieved effective attenuation of oxidative stress and inflammation - Greater drug deposition across the skin SC	140-141
Phytosomes	Cocoa pod extract, Arbutin	- Significant enhancement of antioxidant activity (IC50 of 199.98 ppm)	144-145

		- Higher drug entrapment efficiency comparable to conventional aqueous formulation - Facilitated skin absorption (>80%) and increased efficacy	