Surface modified Niosomes entrapping Minoxidil: Targeted Drug Delivery platform to treat Alopecia

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Background: Alopecia defined as loss of hair from the scalp and other parts of the body may be involved in some types. It is a term comes from the Greek alopex," fox" relating to manage in foxes and may be include a huge variety of conditions such as autoimmune, genetic, environmental and infectious. The appearance of clinical manifestations can diversify depend on the pathogenesis of this disease. Scaring and non-scaring are two types of alopecia. Scarring alopecia is classified into primary and secondary according to cause of destruction of hair follicle, while non scarring hair loss is classified according to the cause into: androgenic alopecia, alopecia areata, traction alopecia, effluvium (anagen and telogen), tinea capitis and trichotillomania. In 1965 scientists discovered the potent antihypertensive effect of minoxidil and since then it has been used as a treatment for hypertension, but later it was found that it could be used for treatment of alopecia "e.g. androgenic alopecia ,anagen effluvium ,alopecia areata and traction alopecia'' due to its hpertrichotic effect. Minoxidil entrapped in niosomes coated with chitosan were prepared to develop targeted drug delivery systems with controlled release profile to treat alopecia

Methods: Niosomes composed of span 60 and cholesterol in molar ratio 1:1 (F2) coated with chitosan (F3) were prepared using thin film hydration method and evaluated for particle size, zeta potential using mastersizer, entrapment efficiency, morphology using scanning electron microscope (SEM), and structure by X-ray diffraction. The prepared niosomes were then incorporated in topical cream (F4) and (F5). The formed creams were evaluated for viscosity using Brookfield viscometer , spreading and irritation properties. In vitro release was also investigated for all formulae and compared to drug suspension (F1)

Results: The results revealed that particle size of (F2) and (F3) were 349.9 nm and 674.9 nm, respectively, While entrapment efficiency of (F2) and (F3) were 22.33% and 13%, respectively. Moreover, zeta potential was -40mV for (F2) and +32 mV for (F3). X- ray diffraction showed that minoxidil is crystalline in nature which didn't change and remained crystalline in all formulae. Viscosity of (F5) was 9000-9300 Cp and 6850-7600 Cp at 6 and 12 rpm respectively, with no irritation and good spreading property. In vitro release after 6 hours of F1, F2, F3, F4 and F5 were 100%, 39.11%, 33.56%, 19.66%, and 12.17%, respectively.

Conclusions: In the light of the aforementioned results, chitosan coated niosomes entrapping minoxidil incorporated in cream were successfully prepared to achieve targeted drug delivery and controlled release as well.