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ENHANCED TOPICAL ADMINISTRATION OF ASTAXANTHIN FROM ACTIVATED NANOGEL

Deepa H Patel and Rohit V Madariya

Parul Institute of Pharmacy and Research, Parul University, Vadodara, India

The aim of the present investigation was to enhanced topical administration of astaxanthin from activated nanogel. The solubility study of drug in different surfactant solution was carried out by optimizing the different surfactant concentration at which maximum drug gets solubilized. Drug-excipients incompatibility study was carried out using Fourier Transforms Infrared spectroscopy (FTIR). A nanogel based on co-polymerized N-isopropylacrylamide (NIPAM) and butylacrylate (BA) was synthesized, characterized and loaded with astaxanthin by using emulsion polymerization method. Activated nanogel were evaluated for organoleptic characteristic, morphological characteristics, gelling property, particle size, zeta potential, percent drug entrapment, swelling ratio, viscosity, thermal analysis (differential scanning calorimetry), transmission electron microscopy (TEM), *in vitro* drug permeation on rat skin using franz diffusion cell, skin irritation on rat skin and stability. Fourier Transform Infrared Spectroscopy (FTIR) study shows that neither drug decomposition nor drug-excipients and excipient-excipient interactions occurred in the formulation. Solubility of drug was found to be maximum in 1.5% w/v concentration of sodium lauryl sulphate solution. Activated nanogel shows good organoleptic properties. Transmission electron microscopy confirms the nanogel particles were monodisperse by having uniform size and spherical shape. The image also serves to validate the purification step, by the absence of extraneous particulates. Particle size, zeta potential, percent drug entrapment, gelling capacity, viscosity and swelling ratio was found to be 464.90±2.02 nm, -31.7±2.66 mV, 97.19±0.02%, good, 16,000±707 cps and 13.88±0.16 respectively. Differential scanning calorimetry indicated that the lower critical solution temperature for poly (N-isopropylacrylamide-co-Butylacrylate) In deionized water was found to be 31.1˚C and it produced temperature sensitive property. *In vitro* permeation of optimized batch on rat epidermal membrane using in Franz diffusion cells, followed by the addition of saturated aqueous sodium carbonate demonstrated the swelling over the range 25-37˚C, provided a astaxanthin flux of 1.69±0.03 µgcm^{-2}h^{-1} which increased to 0.20±0.0015 µgcm^{-2}h^{-1} upon the addition of saturated aqueous sodium carbonate up to 24 hrs which suggested that the novel mechanism is proposed whereby the change in temperature experienced by the nanogel as it penetrated skin induced de-swelling and expulsion of astaxanthin *in situ*. *In vitro* skin irritation study indicated that no irritation on rat skin. Stability study indicates the developed nanogel was stable at 4-8±2°C / 45±5% RH (Refrigerated) condition after 1 month. In the conclusion, activated nanogel provide nanosized particle size with good percent drug entrapment, increasing flux through skin and better swelling ratio of polymer could be helpful for the topical administration of astaxanthin with enhanced properly in rheumatoid arthritis condition.

pateldeepa18@yahoo.com