INTERACTION OF HYALURONIC ACID WITH DERMAL MEMBRANE: A MOLECULAR DYNAMICS SIMULATION STUDY

Orekhov P.S., Kholina E.G. [1], Vasyuchenko E.P. [1], Zhmurova N.V. [2], Bozdaganyan M.E.[1,3,4]

Moscow Institute of Physics and Technology,
Russia, 141701, Dolgoprudny, 9 Institutskiy per.
[1]Lomonosov Moscow State University, Russia, 119234, 1 Leninskie gory str.
[2] Yesenin Ryazan State University, Russia, 390000, Ryazan, 46 Svobody str.
[3] Federal Research and Clinical Center of Specialized Medical Care and Medical Technologies, Federal Medical and Biological Agency of Russia, Russia, 115682, Moscow, 28 Orekhovy bul.
[4] N.N. Semenov Federal Research Center for Chemical Physics, Russian Academy of Sciences (FRCCP RAS), Russia, 119991, Moscow, 4 Kosygina str.

The skin is the main barrier that prevents the entry of foreign substances into the body. Various strategies are developed to overcome the impermeability of the stratum corneum, the primary barrier to percutaneous drug penetration. One approach for improving percutaneous drug penetration, which has been extensively investigated is the use of chemical penetration enhancers (CPE's). Penetration enhancers often show synergistic effects in enhancing the penetration of the drug into/through the skin.

In the present research we studied the mechanism by which hyaluronic acid (HA), a naturally occurring polyanionic polysaccharide, can penetrate through the skin membrane barrier. The unique viscoelastic nature of HA along with its biocompatibility and non-immunogenicity has led to its use in a number of clinical applications. When applied to the skin HA provides beneficial effects such as skin hydration, elasticity regeneration, and improved wound healing. We've carried out several molecular dynamics simulations to investigate the synergetic effect of two CPEs with HA and found out that two types of investigated chemical enhancers facilitate HA permeation through membrane via distinct mechanisms. While sodium laureth sulfate rapidly incorporates into membrane and destabilyzes it, phenylpiperidine coats HA molecules and allows it to efficiently adsorb onto membrane despite strong electrostatic repulsion between negatively charged HA and lipid species and eventually promotes HA permeation across membrane.

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