Reinventing the Eyedrop: the story of Cationorm

Making an optimal eyedrop formulation has always been a major challenge; compromises had to be made. Nanodroplet emulsion technology has changed that. Here’s how.

By Mark Hillen

Dry eye disease is a common disorder, that’s estimated to affect between ten and thirty percent of patients aged over fifty years (1). Many treatment options exist, but almost all come in one form: topical eyedrops.

Historically, formulating those eyedrops has been a problem (2). Making an eyedrop that can deliver effective and long-lasting dry eye symptom relief to the surface of the eye has been a particular challenge. Aqueous formulations wash away quickly and cannot be used as a vehicle for lipophilic drugs. Emulsions can be; as surfactants can be used to bind together the hydrophilic with hydrophobic oil-based vehicles. However, the overall electrostatic charge of the emulsion matters. Mucins on the surface of the eye are negatively charged – so anionic emulsions will be actively repelled. By the same token, cationic emulsions are actively attracted, dramatically increasing retention time and improving the spreading of the emulsion across the eye surface.

The most effective emulsion coverage requires nano-sized droplets. As the droplet size reduces, the surface area to volume ratio increases, meaning a greater total surface area of the emulsion is exposed to the ocular surface. In essence, the eye sees more of the eyedrop this way.

But there is a challenge in developing this technology: the list of excipients that are acceptable to use in ophthalmic eyedrop formulations is painfully short. Despite those potential setbacks, researchers from Santen’s Novagli Innovation Center in Evry, France have managed to make that cationic nanodroplet vehicle: the Novasorb technology.

The vehicle alone is being used therapeutically today in Europe, and is being marketed by Santen under the name Cationorm. Notably, Cationorm has many properties that are protective of all three layers of the tear film: the oily core protects and replenishes the lipid layer and reduces evaporation; the glycerol present has an osmoprotective effect on the aqueous layer, and the eyedrops are held there for longer by electrostatic attraction.

References
What's in a Cationorm nanodroplet?

96.92% w/w purified water

Non-ionic surfactants

Oily core

Cationic surfactant

96.92% w/w purified water

Stabilizes the emulsion

Makes the oil droplets positively charged

Potential anti-inflammatory properties

Electrostatic attraction leading to optimal spreading and dispersion on the ocular surface

Tear film stabilization

Hyaluronic acid
Antioxidants
Cationorm

Dynamic versus single measurement and base with 6.94 sferic content (2)

All excipients authorized for ophthalmic use

Osmoprotection
pH buffer
Cationic surfactant
Non-ionic surfactants
Paraffin oil

Ointment base, Lubricant, 0.1% w/v
Ointment base, Ointment base, Lubricant, 0.1% w/v
Negative, 5% w/v
Positive, 5% w/v
Non-medicated, Ointment base
Hair removal oil
Lubricant, Oil