Available online on www.ijddt.com
International Journal of Drug Delivery Technology 2018; 8(1); 1-5

ISSN: 0975 4415

Research Article

pH Triggered *In-situ* Gelling Ophthalmic Drug Delivery System

Kurniawansyah I S*, Rahmi F, Sopyan I

Department of Pharmaceutic and Pharmaceutical Technology, Faculty of Pharmacy Universitas Padjadjaran
Jl. Raya Bandung Sumedang Km 21 Jatinangor West Java Indonesia 45363

Received: 7th Sept, 17; Revised: 29th Dec, 17, Accepted: 24th Feb, 18; Available Online: 25th Mar, 2018

ABSTRACT
Eyes are delicate and most vital organs of the body whose defence mechanism restricts entry of exogenous substance. Conventional drug delivery systems get washed off within a short period of time that usually cause poor bioavailability and therapeutic responses because high tear fluid turnover and dynamics cause rapid elimination of the drug from the eye. *In-situ* gelling ophthalmic drug delivery system is one of the new methods that is developed to overcome this bioavailability problems. *In-situ* gelling systems are viscous polymerbased liquids that exhibit *sol-to-gel* phase transition on the ocular surface due to a change in a specific physicochemical parameter like temperature, ionic strength, or pH triggered *in-situ* systems. Using this formulation of pH triggered *in-situ* gel systems, the release of drug can be sustained for longer periods of time, therapeutically more efficacious, non-irritant and stable than conventional eye drops.

Keywords: *in-situ* gel, ophthalmic drug delivery, pH triggered, *sol-to-gel* phase transition.

INTRODUCTION

Eyes are important sensory organs in the human body, which convert light to an electric signal that later will be interpreted by brain[1]. It can restrict the entry of any exogenous substance because of its anatomical-physiological structure and defence mechanisms[2]. But, as eyes are unique organs, they also can be infected by various diseases like conjunctivitis, dry eye syndrome, glaucoma, keratitis, trachoma and so on[3]. Therefore, to target the drug at a required ocular site in therapeutic dose has been one of the most challenging tasks until now[4]. Various factors like nasolacrimal drainage of drug, binding of drug to lachrymal protein, induced lachrymation, availability of limited corneal area create a barrier for absorption of drug through ocular routes[3,5].

There are two types of ophthalmic drug delivery systems, classified as conventional and newer drug delivery systems. The conventional ophthalmic drug delivery system in the form of eye drops, has a dynamic effect and high tear fluid turnover that causes rapid pre-corneal elimination of the drug and also only 1-10% of topically applied drug get absorbed that often results in poor bioavailability and therapeutic response[6]. Consequently, to achieve the desired therapeutic effect, frequent instillation of concentrated solutions is needed. Due to tear drainage, more than 75% of the administered dose of the drug goes through the nasolacrimal duct and goes into the Gastrointestinal tract, leading to systemic side effects[2,7].

In order to enhance the ophthalmic bioavailability and lengthen the residence time of instilled dose, many ophthalmic vehicles have been developed, such as aqueous gels, inserts, ointments and suspensions. However, because of low patient compliance in using the inserts and the side effect of using an ointment such as blurred vision, these ocular drug delivery systems have not been used extensively until now.

For the past few years, this new drug delivery systems that have been developed received significant interest by ophthalmologists is *in-situ* gel systems. *In-situ* gel forming system has showed their potential in increasing the residential time because of bio-adhesiveness of formed gel that has been produced. Additionally, polymers used to achieve *in-situ* gelling may result in sustained release of drug molecules[8,9,10].

In-situ gelling systems are described as low viscosity solution that phase transition in *cul-de-sac* to form viscoelastic gel. This *sol-to-gel* phase transition happens due to conformational changes of polymer in response to a physiological environment. *In-situ* formulations are more acceptable for patient because they are administered as solution or suspension which immediately undergoes to gelation as coming in contact with the eye[11].

Depending on the method chosen to cause *sol-to-gel* phase transition on the surface of the eyes, three types of *in situ* gelling systems are widely accepted namely ion activated systems, pH triggered systems and temperature sensitive systems[4]. The ideal properties for *in-situ* gel formulation can be divided into three categories involving a physical state – the formulation should be free flowing liquid which allows ease of administration with reproducible dose delivery to the eyes:

Phase transition – as drug has been instilled, it should undergo *sol-to-gel* formation by phase transition[12].

Strength of gel – to withstand the shear force in *cul-de-sac* phase so it can prolong residence time of the drug, and the gel formed should be strong enough[5].

*Author for Correspondence: insan.sunan.kurniawansyah@unpad.ac.id