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Polyethylene glycols in oral and parenteral formulations – a critical review

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Graphical abstract

ABSTRACT

Polyethylene glycols (PEGs) are frequently employed as vehicles in oral and parenteral dosage forms. PEGs have low toxicity, are miscible with aqueous fluids in all proportions, and dissolve many poorly aqueous soluble compounds. Compounds with poor aqueous solubility and resulting poor bioavailability and considerable individual variability in the absorption were shown to provide exceptionally high bioavailability and reduced inter-subject variability in plasma concentrations when dosed as solutions or suspensions in PEGs. The advantages offered by PEGs, however, are not without potential challenges that must also be considered and which are the focus of this review. First, PEGs often may have high solubilizing power for some poorly aqueous soluble compounds, the high affinity of these vehicles for water can potentially lead to precipitation of the dissolved compounds when the formulations encounter an aqueous environment *in vitro* or *in vivo*, resulting in reduced bioavailability of the compounds. Second, PEGs, due to the presence of hydroxyl groups in their structures, are reactive with compounds dissolved within, resulting in the formation of degradation products. Third, PEGs, due to the presence of recurring ether groups in their polymer chains, are also inherently susceptible to autooxidative reactions, resulting in the formation of highly reactive products, which degrade several compounds formulated with PEGs. The objective is to review the applications and limitations of PEGs in pharmaceutical dosage forms and discuss solutions to mitigate challenges that may potentially arise from their use.