Lonely polymers split up faster

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Concentration of dissolved polymers determines solution properties, like viscosity, polymer stability and interaction with turbulence. The polymer concentration is a key parameter in the application of polymeric drag reducing agents, high molecular weight polymers that can reduce drag in turbulent flow: Increasing concentration increases absolute drag reduction (DR) as well as polymer stability, counteracting polymer degradation in turbulent flow. Different theories attempt to reveal the mechanism of DR and to describe polymer degradation in turbulent flow [1]. Most numerical simulations of DR do not account for polymer degradation [2] and in many experimental works viscosity changes induced by the polymeric DR agent are omitted. We investigated the role of Polyethylene Oxide (PEO) concentration in dilute solutions using the pilot scale **Vienna Experiment for Drag Reducing Agents (ViEDRA)** [3], focusing on both the initial DR value of the undegraded polymer and on polymer degradation rate. Changes in solution viscosity by polymer addition and degradation were accounted for, in order to disentangle DR from viscosity effects alone. The experimental observations for polymer concentrations in the range of 25 to 200 wppm revealed a clear dependence of both the initial DR and the polymer degradation rate. The initial DR increased with polymer concentration as previously shown [4], levelling off at a concentration of 200 wppm, whereas degradation was more pronounced at low concentrations. The concentration dependence of degradation rate is not straightforward as all polymer solutions were still in the dilute regime where no polymer-polymer interaction is expected. Our observations challenge theories explaining DR by single polymer contributions.

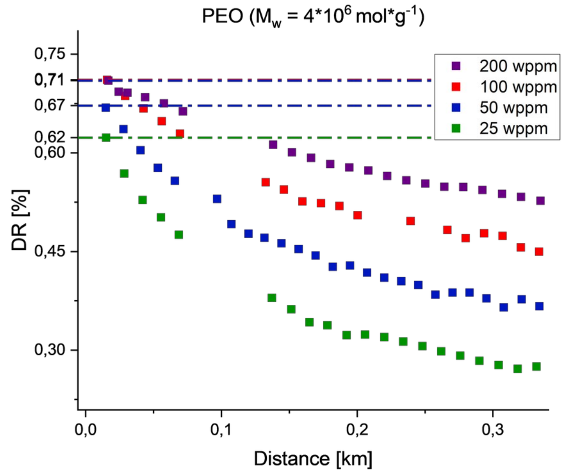

Figure 1: Initial drag reduction (DR) values and the decrease in DR, indicating polymer degradation over longer distances for various concentrations of PEO.

References:

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