The Fluid Characteristic of Mixing Colloid Solution of Polyethylene Oxide (PEO) and Silica Suspension

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ポリエチレンオキサイド（PEO)とシリカ懸濁液の混合コロイドの流動特性

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Abstract: Abstract: Soft matter, represented by gel, is widely used in various fields such as soil stabilization or sanitation, extending the possibility to protect the environment. Shake gel, is a type of gel that is normally in a liquid state transforming into a gel when exposed to shear stress e.g. through shaking, which thickens it. As a result of these two properties, it may be used for a number of purposes. This experiment characterized the fluid under numerous conditions by controlling the pH, temperature, and solvents, through observation of the gel before and after shaking, as well as the measurement of viscosity using a rheometer. A literature review shows that previous research has a tendency to focus on the characteristics under certain conditions, including controlled shear stress, particle size or shape, as well as the amount of polymer. However, there is very little information regarding the shake gel under the above conditions.

Shake gel prepared using a silica suspension and PEO (1.5 wt %), with a range of Cp (mg/m2) (obtained by dividing the additional amount of PEO by the total amount of silica) was 0.05-0.15 mg/m2, shear thickening occurred easily and a permanent gel was formed, especially at pH 8. This is probably due to the particle surface not being saturated by polymer, the repulsion decreased as H+ increased. In addition, when the temperature range was between 10 − 40 ˚C, it was difficult to maintain the gel state with a rising temperature. This may be due to a contraction of polymer with an increased temperature.

要旨: ゲルに代表されるソフトマターは地盤改良やサニタリー等様々な分野で使用され，環境保全の手法の幅を広げる。シェイクゲルはその一種であるが，液体状態から振とう等によるせん断応力でシアシックニングが生じ，ゲル状態へと相転移する。この 2 種の性質利用により，応用方法拡大が期待できる。先行研究にはせん断応力，粒子径や形，ポリマー量を条件変化させた報告は多いが，pH や温度，溶媒の報告は少ないため，今回それらの条件下での流動特性の研究をゲルの観察と粘度測定で行った。シェイクゲルはシリカ懸濁液と PEO (1.5 wt %)で作成した。Cp (PEO 添加量をシリカの総表面積で割った値)の範囲が 0.05-0.15 mg/m^2 である時, pH8 で恒久的なゲルが発生した。これは粒子表面のポリマーの不飽和状態とプロトン増加による反発力低下によるものと考えられる。また温度が 10 - 40 ˚Cの間では，高温になるに従いゲルの維持時間が短縮した。これは温度上昇に伴うポリマー収縮によると考えられる。