

【Grant-in-Aid for Scientific Research (S)】

Biological Sciences (Agricultural Sciences)



Title of Project : Environmental Interface Engineering Based on Dynamic Analysis of Colloidal Flocculation

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Research Area : Agricultural engineering

Keyword : Inhomogeneous colloid, flocculation, sedimentation, electrokinetics, bioresources

【Purpose and Background of the Research】

Any kind of nutrients, minerals and hazardous substances present in nature and water environment, are apt to adsorbed and to be concentrated on the surface of environmental particles, such as clay or fine organic substances. This tendency will be enhanced for chemical substances with high hydrophobicity such as dioxin or heavy metals. In addition, these particles will have a tendency to aggregate into large flocs. Under such condition, flocs are more important unit of transportation rather than individual colloidal particles.

The objective of this research is to carry out the systematic analysis of flocculation dynamics focusing that colloidal system in nature and engineered system composed of nano-particles and dissolved organic matters under the condition of turbulent flow. On the basis of obtained results, the engineering science of colloid and interface in soil and water and biological system will be created and be developed to various directions.

【Research Methods】

The three subjects, ①dynamics of flocculation of colloidal particle involved in the adsorption of organic molecules in flow field, ②electrokinetics of porous colloid complex, ③turbulent sedimentation and rheology of flocculated material will be placed as core domains, in which advanced analysis of theoretical and experimental aspects are systematically implemented. Obtained results and developed methods will be utilized in the practical field of, ④ the solid-liquid separation of concentrated suspension, ⑤ flocculation and electrokinetics of the colony of micro-biology, ⑥ forming process of water-quality in relation to the transportation of cohesive sediments in an ecological structure. Systematic engineering development will be automatically done throughout these utilization activities (refer to the figure) .

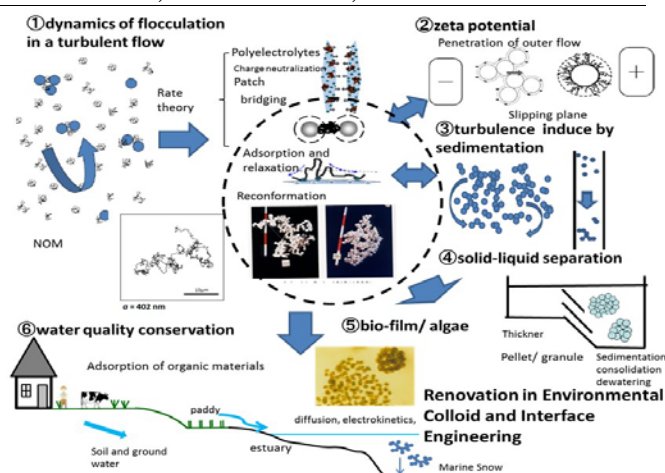


Figure.1 Scheme of Study

【Expected Research Achievements and Scientific Significance】

Understanding of flocculation dynamics is a key factor to clarify the relation between microscopic interaction of colloidal particles and macroscopic transport phenomena. Analysis of the rate theory of flocculation of colloid particle with inhomogeneous surface properties with porous structure is new and will largely contribute to the understanding of more practical system.

【Publications Relevant to the Project】

- Tsuchi no koroid gensho - Physical chemistry of soil and water environment - Yasuhisa Adachi, Shingo Iwata, Gakkai Shuppan Center (2003)
- Dynamics of polyelectrolyte adsorption and colloidal flocculation upon mixing studied using mono-dispersed polystyrene latex particles, L. Feng, M.A. Cohen Stuart, Y. Adachi, Adv. in Colloid and Interface Sci.226,101-104 (2015)

【Term of Project】 FY2016-2022, 10,200,000yen

【Homepage Address and Other Contact Information】

http://www.eng.bres.tsukuba.ac.jp/colloid/JSPP_kaken_S.html