

MRI を利用したエマルションおよび 微粒子懸濁剤の分散状態の可視化

Visualization of Dispersion States of Emulsions and Suspensions Using Magnetic Resonance Imaging

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Abstract

Magnetic resonance imaging (MRI) is a widely used molecular imaging technique, particularly in the medical field. In addition to its nondestructive monitoring capability, MRI enables visualization of molecular mobility through magnetic resonance (MR) parameters, including T_2 relaxation times as well as the apparent diffusion coefficient (ADC). In this study, we demonstrated the applicability of MRI for evaluating the dispersion states of emulsions and suspensions. Emulsions used in milky lotions and skin creams were prepared, and their creaming behavior was monitored using T_2 and ADC maps. For suspensions, 15-nm titanium dioxide (TiO_2) nanoparticles, commonly used in sunscreen products, were dispersed in organic solvents such as ethanol, and their sedimentation behavior was monitored. The experimental results showed that MRI-based molecular mobility visualization can detect subtle changes in dispersion states that are not observed by visual inspection. Therefore, we conclude that MRI is an effective tool for evaluating the dispersion states of both emulsions and suspensions. Overall, this study proposed a novel MRI approach for assessing the dispersion states of thermodynamically unstable dispersions.

キーワード：MRI、エマルション、懸濁液、 T_2 map

Keywords：MRI, Emulsion, Suspension, T_2 map

1. はじめに

磁気共鳴画像法 (magnetic resonance imaging, MRI) は、核磁気共鳴 (nuclear magnetic resonance, NMR) 現象を利用した分子イメー

ジング技術であり、現在では特に医療分野において欠かせない画像診断法となっている¹⁾。ここで NMR 現象とは、陽子数が奇数の原子核 (荷電した原子核) にラジオ波を照射して励起させ、その後、励起した原子核がエネルギーを放出して基底状態へ戻るまでの一連の挙動を指す。観測対象となり得る原子核は複数存在するが、一般的な MRI では ^1H の NMR 現象を利用している。すなわち、試料中の水や油分などに含まれる ^1H から発せられる NMR 信号を画像

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