

Application of diffusion filter - suppression of signal of small molecule

Product used : Nuclear Magnetic Resonance (NMR)

Application and Features

This is a technique for mixtures. The diffusion filter is applied to reduce signals of components with large diffusion coefficients, such as solvents and small molecules, while signals of components with small diffusion coefficients, such as polymers, are affected to much lesser level. This technique can be used as a solvent suppression method for solvents with large diffusion coefficients. Unlike other solvent suppression techniques, this method differentiates signals based on differences in physical properties. Since this technique does not rely on selective excitation, the signals of polymers overlapped with the signal of solvent can be observed

Measurement

Parameters can be set in the same manner as they are set in conventional diffusion experiments. However, since only one 1D spectrum needs to be measured instead of pseudo-2D data set, the measurement time is almost the same as that for ordinary ¹H NMR spectrum. For example, Fig. 1 shows the relationship between magnetic field gradient strength and ¹H signal intensity for molecules with large and small diffusion coefficients. The red line indicates a component with a large diffusion coefficient (i.e. small molecule), whilst the blue line indicates a component with a small diffusion coefficient (i.e. large molecule). The dashed line indicates that at the magnetic field gradient strength G of 0.3 T/m, the blue component is greatly suppressed, while the red component is almost unaffected. This point represents suitable experimental condition for selective observation of the red component.

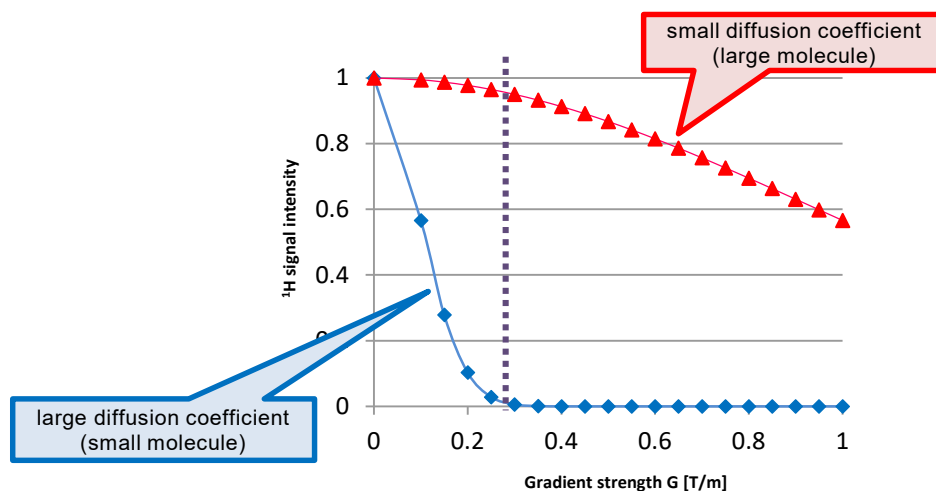


Fig. 1: Relationship of magnetic field gradient strength and ¹H signal intensity

Here, we will demonstrate the effect of diffusion filter on an undiluted solution of hand soap. The ¹H spectrum of this sample is shown in Fig. 2.

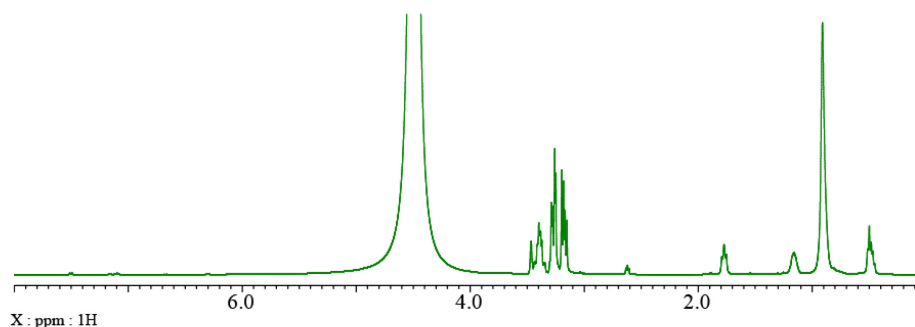


Fig. 2: ¹H spectrum of hand soap

Fig. 3 shows a comparison of the ^1H spectrum (a) and the spectrum collected with diffusion filter (b). The signals in the 1-2 ppm range are observed in both spectra, but the signals in the 2-5 ppm range are not visible in the spectrum with diffusion filter. Therefore, the signals between 2 ppm and 5 ppm can be attributed to a small molecule and the solvent (water).

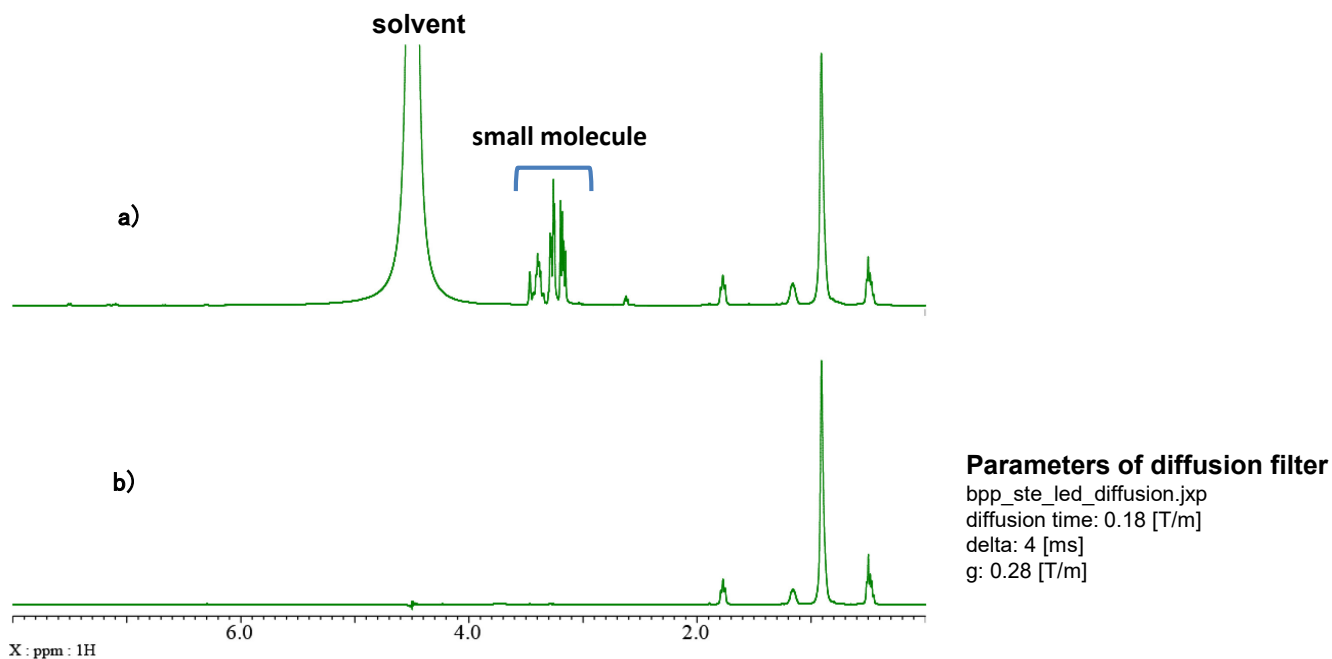


Fig. 3: Comparison of a) ^1H spectrum, and b) Diffusion filter

Fig. 4 shows a comparison of ^1H spectra (a), presaturation (b) and diffusion filter (c). Presaturation suppresses the signal of water at around 4.5 ppm. However, it also suppresses the small signals at around 3.7 and 4.2 ppm indicated with red circles in the spectrum collected with diffusion filter.

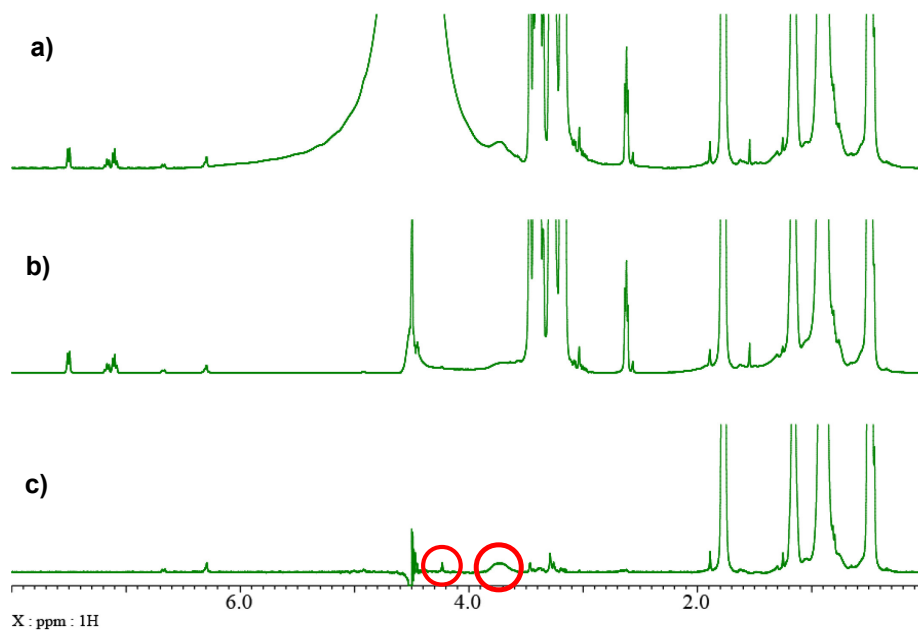


Fig. 4: Comparison of a) ^1H spectrum, b) presaturation, and c) diffusion filter

Copyright © 2022 JEOL Ltd.

Certain products in this brochure are controlled under the "Foreign Exchange and Foreign Trade Law" of Japan in compliance with international security export control. JEOL Ltd. must provide the Japanese Government with "End-user's Statement of Assurance" and "End-use Certificate" in order to obtain the export license needed for export from Japan. If the product to be exported is in this category, the end user will be asked to fill in these certificate forms.



JEOL Ltd.

3-1-2 Musashino Akishima Tokyo 196-8558 Japan Sales Division Tel. +81-3-6262-3560 Fax. +81-3-6262-3577
 www.jeol.com ISO 9001 • ISO 14001 Certified

• AUSTRALIA & NEW ZEALAND • BELGIUM • BRAZIL • CANADA • CHINA • EGYPT • FRANCE • GERMANY • GREAT BRITAIN & IRELAND • ITALY • KOREA • MALAYSIA • MEXICO • RUSSIA • SCANDINAVIA
 • SINGAPORE • TAIWAN • THE NETHERLANDS • USA

Local office

