

Pore size distributions measurement of mesoporous TiO₂ by nuclear magnetic resonance cryoporometry

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This work describes the pore size measurement by nuclear magnetic resonance (NMR) cryoporometry. Cryoporometry is a superior porosimetry measurement to analyze the pore-size and pore-size distributions (PSDs) with nanoscale pores (1-100 nm). NMR cryoporometry, which is non-destructive measurement, is based on the theory of the melting point depression (MPD) of a probe-molecule confined within a pore, which is dependent on the pore diameter. Hydrophilic and/or hydrophobic pore can be measured using a probe-molecule which is sensitive to the hydrophilic and/or hydrophobic circumstance. In order to measure PSDs of mesoporous TiO₂ spheres with various pore sizes, NMR cryoporometry measurements were conducted using hydrophobic probe-molecule. MPD was determined by analyzing the variation of the NMR signal intensity with temperature. From the resulting spin-echo intensity versus temperature curves, it was found that maximum MPD of hydrophobic liquid confined within pores of the mesoporous TiO₂ decreases with increasing calcination temperature, i.e., the pore size increases with increasing calcination temperature. We also confirmed with Barrett-Joyner-Halenda (BJH) analysis that the pore size of mesoporous TiO₂. This trend is in agreement with our NMR cryoporometry results. Overall, these findings indicate that NMR cryoporometry measurement is very effective methods for determining PSDs of mesoporous materials.

Biography

Seung-Yeop Kwak obtained a B.S. degree from the Department of Textile Engineering at the Seoul National University, Seoul, Korea in 1987. He received his M.S. (1989) and Ph.D. (1992) both under the supervision of Professor N. Nakajima in the Department of Polymer Engineering from the University of Akron, Akron, Ohio, USA. He completed his thesis work on polymer nanostructure. His current research interests are membranes for advanced water treatment and for separator of secondary battery. Other interests are eco-friendly plasticizer for replacement of endocrine-disrupting plasticizer. In addition, he also interested in analyses of nanostructure and molecular mobility, i.e., solid-state NMR.

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Silver-based nanoparticles induce apoptosis in human colon cancer cells mediated through p⁵³

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We have systematically investigated the anticancer potentiality of silver-based nanoparticles (AgNPs) and the mechanism underlying their biological activity in human colon cancer cells. Starch-capped AgNPs were synthesized, characterized and their biological activity evaluated through multiple biochemical assays. AgNPs decreased the growth and viability of HCT116 colon cancer cells. AgNP exposure increased apoptosis, as demonstrated by an increase in 4',6-diamidino-2-phenylindole-stained apoptotic nuclei, BAX/BCL-XL ratio, cleaved poly(ADP-ribose) polymerase, p53, p21 and caspases 3, 8 and 9, and by a decrease in the levels of AKT and NF-κB. The cell population in the G1 phase decreased, and the S-phase population increased after AgNP treatment. AgNPs caused DNA damage and reduced the interaction between p53 and NF-κB. Interestingly, no significant alteration was noted in the levels of p21, BAX/ BCL-XL and NF-κB after AgNP treatment in a p53-knockout HCT116 cell line. AgNPs are bona fide anticancer agents that act in a p53-dependent manner.

Biography

Shakti Ranjan Satapathy is pursuing doctoral studies in KIIT University, India. He has 7 publications in peer-review journals to his credit. His research interest focuses on cancer biology specifically the anti-cancer potentiality of novel metallic and drug formulated nanoparticles. He is interested in eco-friendly synthesis and characterization of metallic and drug formulated nanoparticles. Currently, he is looking for the anti-cancer potentiality of nanoparticles with special focus on colon and breast cancer and also exploring the signaling pathways involved in the nanoparticle mediated programmed cell death. Primarily, he has studied the role of p53 in silver nanoparticle mediated apoptosis in colorectal cancer models and also investigated the interaction between tumor suppressor gene p53 and NFκB. Now he is looking forward to analyze how the nanoparticles interact with the biological molecules, especially with the protein inside the cancer cells.

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