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Elucidation of softening mechanism in rince-cycle fabric softeners, uneven adsorption: The key phenomenon to the effect of fabric softeners

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Historically, surfactants were at first introduced to protect yarns from breakage in the course of producing them by using machines in thread-manufacturing plants. In this case, the aspect of friction-lowering of the agents was the key mechanism why these agents were used. This history has let us believe that another function of this type - especially the double long chain alkyl ammonium cationic type agents - found to work as softening agent especially for cotton, the softening effect might have also been believed to be caused by the lowering effect of these type of compounds, and thus the conventional theory of the softening mechanism got its position. The evaluation of "softening effect" by the formulators of softening agents had also been done by sensory evaluation which is made of multiple variant senses in which the feeling of friction was "naturally" involved. Our doubt started about this sensory evaluation system as one of the biggest manufacturers of fabric softening agent in Japan. Can slipping feel be the cause of the "real softening" effect of these agents? Our answer was No so that we started the thorough review of academic papers and started to build a new theory by the careful observation of the physical property change happens before and after the use of the softening agents. The conventional theory of the softening mechanism states that softening effect results from the increase in sliding between fibers and yarns. Our new theory of softening effect occurs by inhibiting cross-linkage of hydrogen bonds. A softener plays two important roles: (1) Decrease of the meniscus force between fibers in a drying process, preventing the decrease in distance between the fibers. (2) Softener inhibits the construction of the cross-linkage made of bound-water between fibers. Furthermore, (3) softener has uneven adsorption characteristic presents in the inner part of yarns. A gradation of softener adsorption happens. Thus, two different physical properties of the soft outer part and the hard inner part are the key factors to give the soft and bouncy feel of the fabric. This formation of adsorption gradation brings about the favorable physical property even when only a small amount of agent such as 0.1 % o.w.f. – a current standard concentration - is used.

Biography

Takako Igarashi received a Master's degree of Engineering from Kanazawa University in Japan. Since 1991, she has worked for Kao Corporation as a research scientist in R&D-polymer development division of Material Development labs. and R&D-Household Products Research labs. She is now a senior research scientist in R&D-Household Products Research labs.

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