

Preparation of soluble polysilsesquioxanes containing polyhydric phenol side-chain groups and their adhesive properties

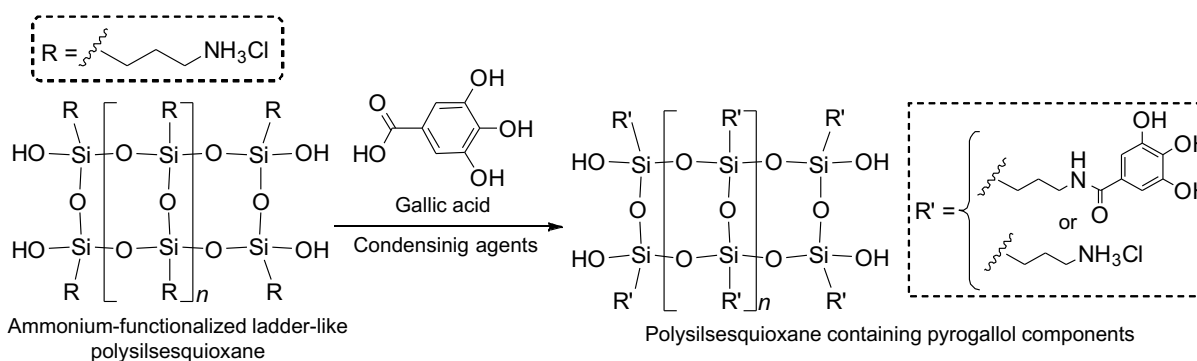
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Abstract

It is well known that mussels can adhere strongly to rocks (on organic or inorganic surfaces) by adhesion protein, which contains polyhydric phenol groups. Therefore, it has been reported that synthetic organic polymers containing polyhydric phenol components, such as catechol¹ and pyrogallol² groups, in the side-chains also function as excellent adhesives.

However, in consideration of long-term use in the natural environment, development of the adhesives excellent in UV and weather resistances are required. Therefore, in this study, we focused on polysilsesquioxanes (PSQs) as inorganic polymers. So far, we have reported that the soluble ladder-like PSQs containing ionic side-chain groups, such as ammonium,³ carboxylate,⁴ sulfonate,⁵ and phosphonate⁶ groups, were successfully prepared by the hydrolytic polycondensation of the corresponding organotrialkoxysilanes as the starting materials. In addition, a water-soluble PSQ containing ammonium and mercapto side-chain groups was recently prepared, which act as adhesives for inorganic materials, such as metals and glasses.⁷ In this study, to prepare soluble PSQs which can be applied to adhesion of various materials, we investigated the preparation of PSQs containing polyhydric phenol components in their side chains.

Preparation procedure of such PSQs is as follows. The condensation reaction (modification reaction) of amino side-chain groups in ammonium-functionalized ladder-like PSQ³ with gallic acid as a compound containing a polyhydric phenol component was performed using condensing agents. The resulting PSQs containing pyrogallol components were able to adhere metal, glass, and acrylic resin plates.



Scheme 1. Preparation of polysilsesquioxane (PSQ) containing pyrogallol components in side-chains.

References

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