The Preparation of Polymeric Fine Powder with Crosslinkage and Its Application as a Mordant

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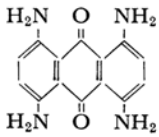
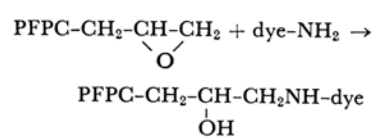
It has been well known that a polymeric fine powder can be prepared by emulsion polymerization; no other method of preparation has yet been reported. A new method of preparing a polymeric fine powder with crosslinkage (PFPC) and its application as a mordant for poorly dyeable fibers will be reported in this paper. Vinyl monomers and divinyl benzene (DVB) were polymerized in some specified solvents (for example, an aliphatic hydrocarbon or an aliphatic alcohol) with stirring using benzoyl peroxide (BPO) as a polymerization initiator; PFPC was thus obtained. Table I shows examples of the polymerization at 80 ±5°C. The usefulness of these solvents may be attributed to the behavior of these solvents, in which the monomers are soluble but the polymer is insoluble. Furthermore, DVB should be effective in promoting the separation of the polymer from the solvent and in making the polymer very fine powdery. The PFPC prepared by this new method was a spherical powder with a diameter of about 0.1 μ or less; accordingly, its application as a mordant for poorly dyeable fibers could be expected.

Also, it has been known that the blend of some dyeable polymers, such as polymethyl methacrylate[1] or polyvinylpyridine[2], is effective in improving the polypropylene dyeability; the dyeable polymer is thus finely dispersed[1] because of its immiscibility to the fiber substrate.[3] The dyeable polymers thus blended can easily be extracted by acetone, but the newly-developed PFPC was inextractable because of its crosslinked structure. A common disadvantage of these blend systems, however, is that the dye in the substrate is not fixed perfectly by the chemical bond, and so can easily be extracted by acetone. Following the general idea mentioned above to improve the dyeability of a polymer-blended system, the author finally decided to apply the glycidyl group to PFPC as a reactive functional group; this proved to be very useful not only in dyeability but also in resistance to the the solvent extraction of the dyeings. Some of the results are shown in Table II.

TABLE II. THE DYEING RESULT WITH CELLITON BLUE EXTRA TYPE*3

Sample blended*1	Color after dyeing	Color after acetone-extraction*2
A	medium colored	none
B	medium colored	none
C	medium colored	medium colored

*1 The quantity of PFPC added: 3.8% by weight.
*2 The extraction was carried out for 8 hr. by the use of a Soxhlet extractor.
*3 



In conclusion, we recommend using PFPC with a reactive functional group which may behave as a mordant in the dyeing of polypropylene fiber. The details will be reported soon.

TABLE I. PREPARATION AND PROPERTIES OF PFPC

Sample	Polymerization conditions: Monomer, g.	DVB g.	Solvent, cc.	BPO g.	Yield g.	Grain size of PFPC, μ
A	MA, 20	2	K, 150	0.1	9	0.1—0.2
B	VAc, 20 AA, 5	5	B, 150	0.3	—	0.1
C	GMA, 44	7	K, 400	0.3	38	0.1

MA: methyl acrylate, VAc: vinyl acetate, AA, acrylamide, GMA: glycidyl methacrylate, K: kerosene, B: *n*-butanol

1) Y. Mizutani, S. Matsuoka and K. Yamamoto, This Bulletin, **38**, 2045 (1965).
2) P. Ginstiani, G. Natta and G. Mazzanti, U. S. Pat. 3115478.
3) H. Hatakeyama and Y. Arata, Japanese Pat. 25788 (1964).