

Suspension Polymerization of Styrene

Ingredients:

Styrene

1, 4-divinyl benzene (if available, must be fresh) 50-60% solution in ethyl benzene

Water

Poly vinyl alcohol (about 50 to 70 kg/mole is good)

dibenzoyl peroxide

Note: The styrene and divinyl benzene contain BHT stabilizer which is a free radical scavenger. Ideally you should distill the reactants but the polymerization can be conducted with the stabilized monomers if you add extra initiator assuming that BHT will consume some of the free radicals. Stabilized divinyl benzene will react if not refrigerated and even if it is refrigerated it is only good for about 3 months. It should be a liquid at room temperature. If it is a rubbery solid it has polymerized and formed a network structure in the bottle that can not be reversed. It is possible to obtain a good product from this polymerization with just stabilized styrene monomer but it is difficult to obtain tiny beads with no DVB. The product should be like small ball bearings that will be interesting to roll around between your fingers or on the table.

Use an Erlenmeyer flask with a magnetic stirrer and a hotstage and a 50 ml beaker for the monomer/initiator.

- 1) Make a solution of 0.1 g benzoylperoxide, 10 ml of styrene and about 1 ml of divinylbenzene in a 50 ml beaker.
- 2) Add 70 ml of water and 100mg of polyvinylalcohol to the Erlenmeyer flask and stir. You need to heat this to dissolve the PVA. Let this cool or if you are in a rush you can just proceed to the next step.
- 3) While vigorously stirring with the magnetic stirrer, add the monomer solution to the water to form a fine suspension. The size of the droplets will decide the size of the beads you form. Smaller beads are obtained by lower monomer concentration, higher stirring rate, more PVA. There are limits to all three of these parameters.
- 4) Heat the suspension to 90 C to initiate the reaction. Depending on the amount of monomer (more is faster) and the amount of initiator (more is faster) the polymerization can yield a good result in from 30 minutes to 7 hours.
- 5) The mixture should be cooled with stirring and then added to a large beaker of propanol during stirring to separate the polymer.
- 6) The product should be washed several times with propanol.

Safety: Try to keep the styrene containing parts of the reaction loosely covered to reduce the vaporization of monomer which has a distinct odor.