Cerritos Community College

Organic Chemistry 211 Laboratory

Stirring and Agitating Reaction Mixtures

Stirring and agitating chemical reactions is desirable and stirring reflux systems or any system under heating is necessary to a) distribute the heat evenly throughout the system and b) to prevent splashing and boilovers. A few common means of agitation are magnetic stirring (via magnetic spin vane or bar), boiling stones, boiling stick (essentially a wood applicator immersed into the reaction mixture).

Magnetic Stir Plates and Stir Bars

A magnetic stir plate (usually integrated with a hot plate) is basically a large magnet located underneath the heating plate, and is connected to a spinning electromotor with a control knob for varying the spinning speed, depending on the rate of stirring desired. As the mixture to be stirred is placed on the hot plate (i.e., on the top of the spinning magnet) the smaller magnetic stir bar located in the reaction mixture is drawn towards the spinning magnet and spins along, thus stirring the reaction mixture.

Magnetic stir bars are classified in a few ways according to their shape and size, which has to do with their usage. Some of the magnetic stir bars used in our laboratories are as follows:

- Spin (stir) Vane: a triangular piece of Teflon-covered magnet which fits the shape of the bottom of the conical reaction vials, available in the microscale glassware kits.

- Stir bar: A medium-to-large sized, rod-shaped, Teflon-covered magnet, which fits the bottom of any flat-bottom flask like Erlenmeyer flsk or a beaker.

- Flea: A very-small sized (the size of a grain of rice) stir bar used only for microscale systems in containers with flat bottom.

Note: . It is a good practice to place the mixture to be stirred, at the center of the magnetic stir plate, in order to have the two magnets fully aligned, and thus to achieve an even and effortless stirring.

Boiling Stones

In refluxing systems that do not require significant mixing or agitation, the stirrer usually is replaced by a boiling stone. These sharp-edged stones possess highly fractured and porous surfaces that are very efficient at initiating bubble formation as the reacting medium approaches the boiling point. The boiling stone acts to protect the system from

disastrous boilovers and also reduces “bumping.” (Boiling stones should only be used once and must **never** be added to a hot solution. In the first case, the vapor cavities become filled with liquid upon cooling, and thus the boiling stone becomes less effective after its first use. In the second case, **adding the boiling stone to the hot solution may suddenly start an uncontrollable boilover)**.