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Addition/Correction

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Potential Hazard with Better Ira Remsen Demonstration

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It has come to our attention that there can be a hazard that was not described in our article. The hazard can arise if the directions given in the article are not followed exactly. Because a partial vacuum created by an aspirator is used to remove $NO_2(g)$ and to provide stirring of the solution, it is essential that demonstrators use a vacuum filter flask and the funnel apparatus described in the article. Replacing the filter flask and funnel apparatus with an Erlenmeyer flask and a separatory funnel can result in sufficient vacuum to cause an implosion of the Erlenmeyer flask.

An implosion occurred when the demonstration was performed using a 4000 mL Erlenmeyer flask equipped with a two-hole rubber stopper. The stopper supported a 50 mL separatory funnel and a 7 mm glass tube that extended about 4 cm into the flask. The top end of the tube was connected to an aspirator using vacuum tubing. The demonstration was carried out as described in our article. The aspirator was turned on after the flask had filled with NO_2 and during the addition of water and aqueous ammonia. The funnel was opened and the water supply turned off at regular intervals to break the vacuum. At the point where the solution had turned green, the addition of water in the Erlenmeyer flask had reduced the gas volume sufficiently that the pressure in the flask changed more rapidly than earlier in the demonstration. Sufficient aqueous ammonia was added to the separatory funnel that all of the liquid could not run into the flask before a significant vacuum developed, and the flask imploded. The implosion scattered liquid and glass onto the demonstrator and several students seated near the demonstration. No one was injured and the pH was high enough (probably 3−4) that the solution posed little hazard. Nevertheless, the possibility of a more serious implosion led us to provide this description.

Under no circumstances should an ordinary Erlenmeyer flask be used to replace a filter flask in this demonstration. Demonstrators who do not have a 4000 mL side-arm filter flask should either scale back the quantities of reagents and use a smaller side-arm filter flask or wait until a large flask has been ordered and delivered. Under no circumstances should a separatory funnel be substituted for the addition device described in our article. The addition device has a much larger bore and allows water and ammonia to be added much more rapidly without creating significant vacuum, thereby lessening the chance of implosion. The demonstration is safe if it is carried out using the apparatus described and illustrated in our article, but if different apparatus is used, there are significant hazards that we did not warn against.

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