

Cigarette Smoking machines

Since the ban on smoking in public places in Scotland came in during March 2006 we have had several enquiries regarding this. For many years we have all carried out this valuable demonstration safely. Risk assessments ensured that none of the harmful products would have been absorbed, via either inhalation or skin, by pupils or staff. The biggest danger would in fact be to the staff cleaning out the tarry messes afterwards.

The formation of the tars and other products of combustion in a burning cigarette is a most important demonstration which all pupils should see. There is no reason for not continuing with it provided suitable precautions are taken.

There have been two main versions :

1. Continuous flow model

A cigarette is placed in a holder (fashioned from a short length of rubber tubing fitted on the end of glass tubing) and lit. The fumes were then drawn away slowly through side-arm filter tubes, the first containing a pad of cotton wool and the second, water with a few drops of Universal indicator added. A slow running water pump can be used to draw the air through. Normally no fumes escape from the burning cigarette. However, if it is found that some fumes do escape from the exhaust water of the water pump, this is due to the cotton wool pad being too small and the air being drawn through too fast. This apparatus can usually be used in a very well ventilated lab, but move it to a fume cupboard if fumes can be smelled. Alternatively the filter pump could be running in a fume cupboard with a long piece of tubing connecting it to the apparatus outside. Some water pumps have a bad habit of sending water back and a large bottle or Winchester with reversed connections makes a good trap.

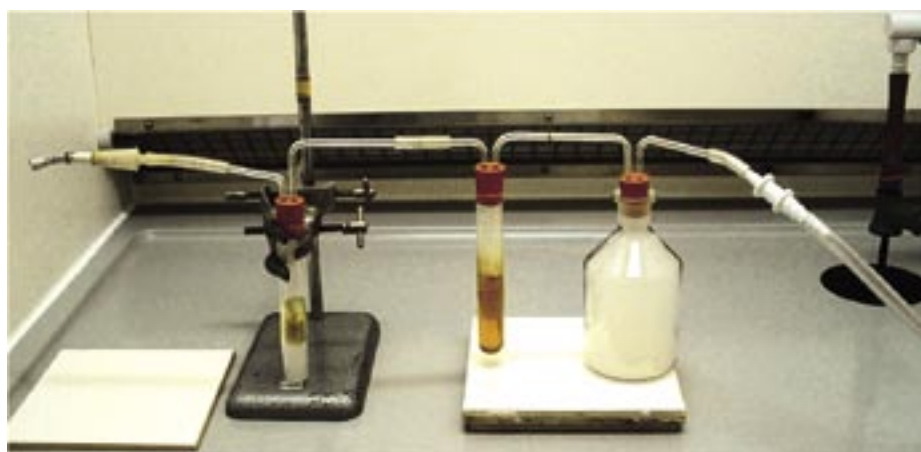


Figure 1 - Continuous flow model with slow-running water pump

2. The "puffing" model

This will definitely produce sidestream smoke and must be done in a fume cupboard. Here the air is drawn in short pulls of about a second but smoke will clearly go into the air around it in the "rest" periods. The safest puffing version is the apparatus (below) which is driven by a hand-operated vacuum pump in place of the water pump (see Figure 2).

An alternative to this is the "puffing dolly". In this version the track or path consists essentially of a filter in a small chamber and a Y piece on which

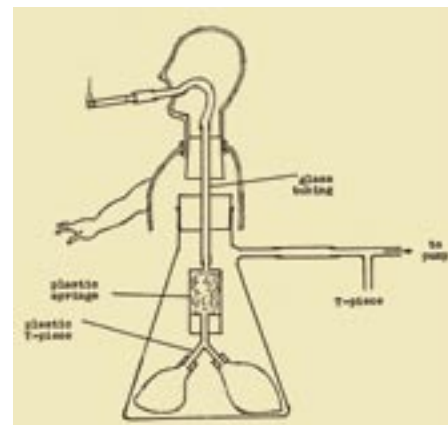


Figure 3 - Puffing dolly from Bulletin 73



Figure 2 - Puffing model driven by a hand-operated vacuum pump

are attached two balloons to represent lungs. With the "respiratory system" fitted in a clear plastic lemonade bottle (representing the chest cavity) a sheet of polythene or rubber can be fitted as a 'diaphragm'. Pulling and pushing the diaphragm causes inhalation and exhalation. We've tested this model and found that although it is suitable for showing lung function it cannot be recommended as a smoking model since the user is potentially exposed to smoke and the tarry residues left afterwards. A similar design was first seen way back in SSERC Bulletins 38 and 73. The latter showed

a design for a 'smoking doll' - my, how times have changed! (see Figure 3).

Two further points should also be considered :

a) The air draught in a fume cupboard with a highish face velocity may cause the cigarette to burn too fast. Raising the sash may help. If the cupboard has a bypass and the draught can't be sufficiently reduced, switch off the fume cupboard for half a minute or so whilst the cigarette is burning and then switch it on to capture the fumes and prevent them from drifting out into the laboratory air.

b) Disposal must be carefully done. At the end a squirt of water from a wash bottle will extinguish the cigarette. The tar in the trap will contain potent carcinogens and should not be handled. Wearing nitrile gloves and with the aid of tongs in a fume cupboard remove the tarry filter, place it in a plastic bag, seal it and place with ordinary waste.

Likewise any paper towels used in wiping the inside of the tubes should be disposed of in the same way. Also, as it is a demonstration and not done on a class scale, consider discarding the tarry test tubes, etc. The rest of the kit will still be somewhat contaminated and should be stored in a closed box or bag.