

Correspondence

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Adsorption of Ether by Activated Charcoal

To the Editor:—Kim and Sircar¹ have evaluated the adsorption characteristics of five anesthetic vapors on charcoal. However, diethyl ether was not studied. I wish to report that the adsorption of ether by activated charcoal does not conform to the principles enunciated by Kim and Sircar. They stated that using a suitable charcoal, adsorption occurs over a narrow zone, with little increase in temperature from the exothermic process. As a result, the passage of this transfer zone ensures that the charcoal is saturated with vapor at the temperature of the inflowing gases.

Ether differs from the volatile agents studied by Kim and Sircar in being present in high concentrations. Thus, ether, 8 per cent, might be expected in exhaust gases where ether is used to provide fairly deep anesthesia.² The practical result of such concentrations when adsorbed on activated charcoal is the liberation of a considerable amount of heat at the transfer zone. The heating of the activated charcoal decreases its adsorptive capacity, since adsorption is inversely proportional to absolute temperature.³ This, together with the large amount of heat generated, results in a widening of the transfer zone. With a wide, hot transfer zone, failure of efficient adsorption occurs sooner than we would forecast on the basis of Kim and Sircar's work. Epstein,² whose paper published in 1944 provides an excellent basis for development of charcoal adsorption systems, recognized that ether adsorption was not isothermic and provided water jackets to cool his metal canisters. He did not publish the temperature changes associated with ether adsorption by water-cooled canisters. He used 6–8-mesh charcoal and found that 600 g adsorbed 8 ounces ether over 70 minutes when water cooled before "breakthrough," which was defined as more than 1.25 per cent ether in the effluent vapor, occurred. Thirteen hundred grams of charcoal adsorbed 18 fluid ounces over two and a half hours before breakthrough occurred.

Activated charcoal for adsorption of anesthetic vapors is commercially available in the United Kingdom.³ My own awareness of the heating effect of ether adsorption resulted from use of an adsorption unit during a long operation in which hypothermia was used. Ether was preferred to maintain vasodilation during surface cooling. The charcoal adsorber used

became noticeably hot during this process, and ether vapor was noticed after about a quarter of an hour. Subsequently, I passed 7 l nitrous oxide, 70 per cent, in oxygen with ether, 10 per cent, into a cardboard canister packed with 4–16-mesh activated charcoal, weighing 1 kg. Under these conditions the charcoal became heated in 10 minutes to a temperature of 70 C recorded 2 inches from the top of the charcoal and 2 inches into the charcoal. The center recorded a temperature of 60 C, suggesting that tracking was occurring. I am now engaged in quantifying this process.

The practical result is that activated charcoal in a cardboard container is not able to adsorb ether in high concentrations for a significant length of time. In the United Kingdom the use of ether is restricted largely to tonsillectomy in children, where removal of polluting gases represents a complex problem. However, in many countries ether is recognized as a safe, cheap anesthetic, and concern over pollution might result in adsorption methods being used, particularly now that such methods can be incorporated into suction scavenging systems.⁴ On the available evidence, ether adsorption should be undertaken in metal, cooled canisters, regenerated after two hours' use, and disposable cardboard canisters reserved for occasional use where ether is indicated, but antistatic precautions might be inadequate.

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