

The Isotopic Fractionation of Water by Distillation and by Adsorption

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The Isotopic Fractionation of Water by Distillation and by Adsorption*

The discovery¹ that water in which the heavier isotopes of H₂ and O₂ have been concentrated by electrolysis has a higher boiling point than normal water shows that it must be possible to fractionate water by distillation. To demonstrate this, 10 liters of water having a specific gravity of 1.000053 were distilled at atmospheric pressure in a still provided with a 35-foot rectifying column. An initial distillate of 200 ml and the final residue of 100 ml were compared as to density and found to differ by 64.9 parts per million, the residue having increased by 53.3 parts and the distillate having decreased by 13.2 parts. Distillation fractionation is thus possible and should find practical application in combination with electrolysis fractionation.

The adsorptivity of water by porous materials or powders should vary with its isotopic composition and it should therefore be possible to fractionate water by adsorption. To demonstrate this 300 g of activated charcoal was allowed to stand for three weeks immersed in 500 g of water having a specific gravity of 1.000053.

The supernatant water (176 ml) and the last 123 ml of water which could be expelled from the charcoal by heating in vacuo at 500°C were compared as to density and found to differ by 12.4 parts per million, the supernatant water having decreased by 6.5 parts and the adsorbed water having increased by 6.7 parts.

The specific gravities reported above were determined on carefully purified samples of water and are based upon normal water taken as unity.

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EDGAR R. SMITH

Bureau of Standards,
Washington, D. C.,
May 15, 1933.

* Publication approved by the Acting Director, Bureau of Standards, Department of Commerce.

¹ Washburn, Smith and Frandsen, J. Chem. Phys. 1, 288 (1933).