

# Kerosene: A Substitute For Acetone In Bone Preparations

T Ajayi, Alakija, O Ijisan, I Huthman, O Olaseinde, T Adenowo, A Adefule, A Huthman

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## Abstract

Kerosene is one of the by-products of fractional distillation of crude oil. It is a hydrocarbon and used domestically in the kitchen and industries for powering plants and automobiles. This study was carried out to appraise the defatting effects of kerosene on the caprine and porcine skulls. Bones were divided into 2 groups; one group was defatted by kerosene while the control was defatted by acetone. Our preliminary observations showed that kerosene had a strong clearing effect on bones. This effect competed favorably well with the actions of acetone used in the control group. By these preliminary observations kerosene may economically and functionally replace acetone in osteological preparations; if more basic studies of this nature are carried out.

## INTRODUCTION

Kerosene, sometimes spelled kerosine in scientific and industrial usage, also known as paraffin, is a combustible hydrocarbon liquid. The name is derived from Greek keros (wax). The word Kerosene was registered as a trademark by Abraham Gesner in 1854 and for several years only the North American Gas Light Company and the Downer Company (to which Gesner had granted the right) were allowed to call their lamp oil kerosene<sup>1</sup> when it eventually became a trademark. It is usually called paraffin (sometimes paraffin oil) in the UK, South East Asia and South Africa (not to be confused with the waxy solid also called paraffin wax or just paraffin, or the much more viscous paraffin oil used as a laxative); the term kerosene is usual in much of Canada, the United States, Australia (where it is usually referred to colloquially as kero) and New Zealand. Kerosene is widely used to power jet-engined aircraft (jet fuel) and some rockets, but is also commonly used as a heating fuel and for fire toys.

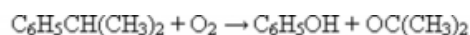
The heat of combustion of Kerosene is similar to that of diesel: its lower heating value is around 18,500 Btu/lb, or 43.1 MJ/kg, and its higher heating value is 46.2MJ/kg.<sup>2</sup> Kerosene is a thin, clear liquid formed from hydrocarbons, with density of 0.78-0.81g/cm<sup>3</sup>. Kerosene is obtained from the fractional distillation of petroleum between 150 °C and 275 °C, resulting in a mixture of carbon chains that typically contain between 6 and 16 carbon atoms per molecule.<sup>3</sup> The

flash point of kerosene is between 37 and 65 °C (100–150 °F) and its autoignition temperature is 220 °C (428 °F)

Kerosene is insoluble in water (cold or hot), but miscible in petroleum solvents. In 2008, Kerosene cost was \$39.92 per 1 million BTUs for heating.<sup>4</sup>

Acetone is the compound with the formula OC(CH<sub>3</sub>)<sub>2</sub>. It is a trigonal planar molecule with a molar mass of 58.08g/mol. It is a colourless liquid with a density of 0.79g/cm<sup>3</sup> and a melting point of -94.9°C and boiling point of 56.53°C. Acetone is miscible in water and a viscosity of 0.32cp (20°C). This colorless, mobile, flammable liquid is the simplest example of the ketones, owing to the fact that acetone is miscible with water it serves as an important solvent in its own right, typically as the solvent of choice for cleaning purposes in the laboratory. More than 3 million tonnes are produced annually, mainly as a precursor to polymers.<sup>5</sup> Acetone is produced directly or indirectly from propene. Most commonly, in the cumene process, benzene is alkylated with propene and the resulting cumene (isopropylbenzene) is oxidized to give phenol and acetone:

## Figure 1



This conversion entails the intermediacy of cumene hydroperoxide,  $\text{C}_6\text{H}_5\text{C}(\text{OOH})(\text{CH}_3)_2$

Acetone has many uses and is used as a solvent by the pharmaceutical industry and as a denaturation agent in

denatured alcohol.<sup>6</sup>

Acetone is fluorescent under ultraviolet light, and its vapor may be used as a fluorescent tracer in fluid flow experiments,<sup>7</sup> and it has also been hypothesized that the high-fat low-carbohydrate ketogenic diet used clinically to control drug-resistant epilepsy in children works by elevating acetone in the brain<sup>8</sup>. Acetone is used for defatting bones for it is a very good defatting agent but it is rather expensive, highly volatile and requires a glass or metal jar because it dissolves most plastics<sup>9</sup>.

Defatting is an important procedure carried out so as to prevent the bones from looking dirty, attracting dust and also to make bleaching easier. Historically many chemicals have been used as a form of defatting agent but the most widely accepted is acetone which is currently used till date, some of other chemicals are listed below;

1. Benzene has been used although cheap and a good defatting agent it is volatile and a closed jar is needed<sup>9</sup>
2. Trichloro ethylene it is also a very good defatting agent which has similar features to acetone but is toxic and carcinogenic and requires professional assistance<sup>18</sup>
3. Ammonia is a fairly good defatting agent recommended for big skulls, it is somewhat volatile with irritating vapour and can be reused once<sup>9</sup>
4. Hot soap, very cheap it involves mixing water with dish washing soap and warmed to 80°C which must never boil and can only be used in an incubator or with a powerful thermostat<sup>9</sup>

Acetone is the most commonly and currently used defatting agent<sup>10</sup>. Some prefer to defatten using the mixture of acetone and dehydrated ether<sup>11</sup> while some prefer to use it alone when using it alone the bone sample is immersed in 100% acetone for one hour after maceration so as to remove potentially superposed adipose tissue before bleaching<sup>10</sup>. The aim of this study is to compare the defatting effect of kerosene with the conventional acetone which is used in most laboratories to defatten bones. We figured out that if we can carry out an experiment to compare the effects of kerosene and acetone on bones, we might be able to replace acetone with kerosene which is cheaper, non volatile, non toxic and easily available. Our objective is to compare the defatting effect of kerosene and acetone on a porcine and

caprine skull and see if it can be replaced with kerosene.

## **MATERIALS AND METHOD**

### **MATERIALS**

1. 960g goat head
2. 1.2kg pig head
3. 5 litres kerosene
4. 5 litres acetone
5. Stove
6. Pot
7. Detergent
8. Scalpel

### **METHOD**

We obtained a 960g goat head and 1.2kg pig head from Sabo market Sagamu.

The goat and pig head were macerated in boiling detergent for one hour<sup>12</sup> and we then separated the mandible from the skulls for comparison.

The pig skull was defatted with kerosene for 2 hours and the mandible with acetone<sup>10</sup> for 1 hour and the caprine skull [control] with acetone for 1 hour and the mandible with kerosene for 2 hours, since kerosene is the test solvent. They were then left to dry. Afterwards the specimens were compared.

### **RESULT**

We observed that the bones that were immersed in 5 litres of kerosene competed favorably well with those defatted with 5 litres of acetone. These observations reveal that kerosene as a by-product of the fractional distillation of crude oil proved to be an effective defatting agent in bone preparation.

We also observed that kerosene proved to be cost effective in view of its low cost and availability as compared to acetone which is very costly and not readily available. The result of the experiment showed that kerosene was able to defatten the bones and the effect competed favorably with acetone after the bones were immersed in both solutions for 2 and 1 hours respectively and then dried<sup>13</sup>.

**Figure 2**

A TABLE SHOWING THE COMPARISM BETWEEN PRICES OF VARIOUS CHEMICALS USED

SPECIMEN	QUANTITY	PRICE [\$]
KEROSENE	5litres	2.3
ACETONE	5litres	20
DETERGENT	60g	0.27

We also discovered that 5liters of kerosene costs only \$2.3 while 5liters of acetone cost \$20 of which the acetone is not just only expensive but not readily available in rural settings like the university environment. It was then figured out that if more research is carried out in this respect, Kerosene can be used to replace acetone which is more costly and less easily available. If kerosene can replace acetone then it would be easier for people especially students to defatten bones whichever settings they may find themselves without necessarily having to have access to standard laboratory hence more specimens can be easily be defatted which will better equip our anatomical museums.

### CONCLUSION

Bone preparation for use in medical schools, natural history museum and in forensic analysis<sup>13</sup> can be made easier, cheaper and faster if readily made available materials such as kerosene can replace the conventional chemicals such as acetone. The very high cost and unavailability in most parts of the country especially the rural university

Community is also a drawback.

### References

1. Asbury, H. The golden flood: an informal history of America's first oil field. Knopf .AA; 1942:5.
2. Annamalai, Kalyan; Puri IK. Combustion Science and Engineering. CRC Press. ; 2006:851.
3. Collins C. Implementing Phytoremediation of Petroleum Hydrocarbons. In: Methods in Biotech. Humana Press. ; 2007: 23:99-108
4. Ryan, Matt. Homeowners seek cheaper winter heat. Burlington Free Press; 2008.
5. Stylianos S, Levy AB. Acetone in Ullmann's Encyclopedia of Industrial Chem. Wiley-VCH, Weinheim; 2005.
6. Weiner, Myra L, Lois A. Kotkoskie. Excipient Toxicity and Safety; 1999:32.
7. Lozano A, Yip B and Hanson R K Acetone: a tracer for concentration measurements in gaseous flows by planar laser-induced fluorescence. Exp. Fluids;1992;13: 369–376.
8. Likhodii SS, Serbanescu I, Cortez MA, Murphy P, Snead OC, Burnham WM Anticonvulsant properties of acetone, a brain ketone elevated by the ketogenic diet. Ann Neurol.; 2003; 54 (2): 219–226.
9. Gestel WV. Cleaning skulls and skeleton. In: maceration; 2001.
10. Svensson J, Lal S, Dickson SL, Bengtsson BA, Romer J, Ahnfelt-Ronne I, Ohlsson C, Jansson JO. The GH secretagogues- Ipamorelin and GH releasing peptide-6 increase bone mineral content in adult female wistar rats. J endocrinol; 2000; 165, 569-577.
11. Emily R, Holton M, Bernard P. Halloran, Lawrence P. Gareeto, Stephen B. Doty Animal housing influences the response of bone to spaceflight in Wistar rats. J Appl Physio; 2000 ; 88(4), 1303-1309
12. Tompsett DH- In:Anat Techniques, 2nd edition-E&S, Livingstone London;1961; 242-247
13. Louise Scheuer - Application of osteology in forensic medicine. Clinical Anat; 2002; 15 297-312

**Author Information**

**T. Ajayi**

Department of Anatomy, Faculty of Basic Medical Science, Olabisi Onabanjo University

**Alakija**

Department of Anatomy, Faculty of Basic Medical Science, Olabisi Onabanjo University

**O. Ijisan**

Department of Anatomy, Faculty of Basic Medical Science, Olabisi Onabanjo University

**I.O. Huthman**

Department of Anatomy, Faculty of Basic Medical Science, Olabisi Onabanjo University

**O.F. Olaseinde**

Department of Anatomy, Faculty of Basic Medical Science, Olabisi Onabanjo University

**T.K. Adenowo**

Department of Anatomy, Faculty of Basic Medical Science, Olabisi Onabanjo University

**A.K. Adefule**

Department of Anatomy, Faculty of Basic Medical Science, Olabisi Onabanjo University

**A.S. Huthman**

Federal Institute Of Industrial Research Oshodi (FIRRO)