Kerosene: A Substitute For Acetone In Bone Preparations

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Citation

T Ajayi, Alakija, O Ijisan, I Huthman, O Olaseinde, T Adenowo, A Adefule, A Huthman. *Kerosene: A Substitute For Acetone In Bone Preparations*. The Internet Journal of Biological Anthropology. 2010 Volume 4 Number 2.

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 defattening effects of kerosene on the caprine and porcine skulls. Bones were divided into 2 groups; one group was defattened by kerosene while the control was defattened 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 [1] 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.[2] Kerosene is a thin, clear liquid formed from hydrocarbons, with density of 0.78-0.81g/cm^3. 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.[3] 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.[4]

Acetone is the compound with the formula $OC(CH_3)_2$. 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/cm3 and a melting point of -94.9c and boiling point of 56.53c. Acetone is miscible in water and a viscosity of 0.32cp (20c). 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.[5] 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

$$C_6H_5CH(CH_3)_2 + O_2 \rightarrow C_6H_5OH + OC(CH_3)_2$$

This conversion entails the intermediacy of cumene hydroperoxide, $C_6H_5C(OOH)(CH_3)_2$

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

denatured alcohol.[6]

Acetone is fluorescent under ultraviolet light, and its vapor may be used as a fluorescent tracer in fluid flow experiments,[7] 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[8]. Acetone is used for defattening bones for it is a very good defattener but it is rather expensive, highly volatile and requires a glass or metal jar because it dissolves most plastics[9].

Defattening 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 defattening agent but the most widely accepted is acetone which is currently used till date, some of other chemicals are listed below;

1. Benzine has been used although cheap and a good defattener it is volatile and a closed jar is needed9
2. Trychloro ethelene it is also a very good defattener which has similar features to acetone but is toxic and carcinogenic and requires professional assistance18
3. Ammonia is a fairly good defattener recommended for big skulls, it is somewhat volatile with irritating vapour and can be reused once9
4. Hot soap, very cheap it involves mixing water with dish washing soap and warmed to 800C which must never boil and can only be used in an incubator or with a powerful thermostat9

Acetone is the most commonly and currently used defattening agent[10].Some prefer to defatten using the mixture of acetone and dehydrated ether[11] 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[10] The aim of this study is to compare the defattening 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 defattening 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[12] and we then separated the mandible from the skulls for comparison.

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

RESULT

We observed that the bones that were immersed in 5litres of kerosene competed favorably well with those defatted with 5liters of acetone. These observation reveals that kerosene a by product of the fractional distillation of crude oil proved to be an effective defattening 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 1hours respectively and then dried[13].

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 deffatened which will better equip our anatomical museums.

CONCLUSION

Bone preparation for use in medical schools, natural history museum and in forensic analysis[13] 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, Lall S, Dickson SL, Bengtsson BA, Romer J, Ahnfelt-Ronne I, Ohlsson C, Jansson JO. The GH secretagogues- Ipamorelin and GH releasing pepetide-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

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