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Production of Alternative Petroleum Ether and Extractive Power Evaluation

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ABSTRACT

An alternative method to obtain petroleum ether equivalent is described in this study. Two fractions of benzin were obtained, by fractional distillation of available and less expensive benzin, with yield of 13.78 and 18.44% or 32.22% the both. The aptitude of the first fraction was investigated to extract fat. Comparative extractions were done against hexan, heptan and petroleum ether 40-60°C. It was demonstrated that the extracting power of these solvents is comparable. This result may be a very good alternative for researcher from African countries to prepare some liters of solvent for laboratories usage.

Key words: Benzin, hexan, heptan, petroleum ether, fractional distillation, fat, extraction

INTRODUCTION

Lipids of fruit and vegetable have lately received particular attention for every usage like human's consumption and medical usages. Some solvents are commonly used for extraction of fat and oil. Heptan is recommended by the American Association of Cereal Chemists (AACC, 1987). Hexan is very used in the laboratory for extraction of oil matter (Due *et al.*, 2009). Petroleum ether can also be used in instead of heptan for fat extraction (Melgarejo *et al.*, 1995; Matos *et al.*, 2009). Several studies in the literature showed that hexan, heptan or petroleum ether can be used for fat extraction. Gulfraz *et al.* (2009) reported extraction of oil and also unsaponifiable matter from wild olive with petroleum ether. These results showed that, petroleum ether can be used instead of diethyl ether. Looking literature, a lot of works showed that it is not always necessary to found specific solvent.

In the other end, these solvents are not manufactured in most of African countries. African researchers must import it from foreign. In general, after the problem of their expensive price, a second difficulty is the little amount needed in accordance with the special package and mode of transport. In fact, it is well known that transport of solvent by plane is in general forbidden. So, international changes without road or train way could become a very hard difficulty for academic laboratories. Laboratories often need little amount and want to receive solvent as soon as possible. Working with solvent is a strong and not resolved problem for African laboratories. The practice of continuous distillation of solvents like diethyl ether, tetrahydrofuran and methylene chloride was

well known in organic chemistry. So, in the present study, fractional distillation of benzin was performed and extracting power of the selected fraction is compared with commercial hexan, heptan and petroleum ether.

MATERIALS AND METHODS

Benzins were obtained from filling station at Brazzaville-Republique du Congo and are two types in accordance with their colors slightly red or clear red.

Irvingia gabonensis comes from Ouessou, North Congo and was kindly given by Loumouamou. *Bellicositermes natalensis* Haviland was buying in the market at Brazzaville in September 2011.

Distillation was made with a standard glass fractional distillation including "Vigreux 's column" for 25 cm long using a round bottle flask of 2,000 mL for 1,600 mL of benzin. The atmospheric distillation was conducted and fractions were separately recovered from 40-60 and 60-80°C.

Extraction of oil was carried out in a Soxhlet extractor according to the AACC method but with each corresponding solvent.

RESULTS AND DISCUSSION

As presented in Table 1, atmospheric distillation of benzin gave two fractions in the range of 13-15% for first fraction and 16-20% yield for second. The total means amount of distillate solvent was of 32.22% for the two fractions. However, the residue can be used as carburant in diluting it (1 L of residue for twenty liters of commercial carburant). So, there are no waste. Our purpose was not to compare the quality of benzins. So, we found that, these benzins are similar but not identical. Their different apparent have been also shown by their different colors. One liter of benzin costed 595 F CFA (about 0.90 Euros) at Brazzaville in 2011. In accordance with distillation yield, the price of one liter of the prepared solvent is respectively 4,362 F CFA (6.65 Euros) for the first fraction; 3,252 F CFA (5 Euros) for the second and 1,864 F CFA (2.8 Euros) for the mixture. Taking VWR BDH Prolabo for example, the solvents buying price of a liter are 52.40 Euros for hexan (Ref: 24577.298), 60.60 Euros for heptan (Ref: 24751.290) and 30.60 Euros for petroleum ether (Ref: 23826.293). If we include fees, charges and loading time their cost increases the most. Given the yield of distillation and the cost of import, it appears very less expensive to produce your own solvent. The problem of the price can be resolved by in "house-production" of petroleum ether equivalent.

After petroleum ether production, some experiences have been conducted to confirm that it was not always necessary to found specific solvent. So, extraction of oil of *Bellicositermes natalensis* and *Irvingia gabonensis* were performed and the recovery of fat was found to be respectively 52 and 68%. Results from comparative extracting power are shown in the Table 2. These values were similar with those obtained with commercial hexan, heptan and petroleum ether, 50-53% for

Table 1: Distillation of slightly red and clear red benzins

Benzins	40-60°C fraction (%)	60-80°C fraction (%)
Slightly red benzin	233±42 (14.56±2.62)	263±30 (16.44±1.87)
Clear red benzin	208±22 (13.00±1.37)	327±19 (20.44±1.19)
Means	220±32 (13.78±1.99)	295±24 (18.44±1.53)

Results are given as mean values of triplicate distillations in mL of fraction from 1,600 mL and in parentheses are given the corresponding percentage v/v; Followed by±standard deviation

Table 2: Extracting results of 40-60°C distillate, petroleum ether, heptan and hexan

Fat matters (%)	40-60°C fraction	Petroleum ether	Hexan	Heptan
<i>Bellicositermes natalensis</i> oil	52±1	50±2	51±2	53±2
<i>Irvingia gabonensis</i> seed almond oil	68±8	73±4	73±4	n.d.

Results are given as mean values of triplicate analysis in percentage w/w±standard deviation; n.d.: = Not done

Bellicositermes natalensis and 73% for *Irvingia gabonensis*. Present results are in accordance with those found by Matos *et al.* (2009) and Alexis *et al.* (2011) which were, respectively 62.67-73.82 and 65.84% for *Irvingia gabonensis*. These results showed well similarity between different solvents. The present study suggested here a simple and less expensive but equivalent solvent for fat extraction. This result may be used for researcher as described or for pilot local or sub-regional institution to promote availability of solvent for Africans.

CONCLUSION

The results of this study show that, the fraction of benzin distilling at 40-60°C could be used as alternative for commercial hexan, heptan or petroleum ether as extracting or dissolving solvent.

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