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Traditional Techniques of oil extraction from Kapok (*Ceiba pentandra* Gaertn.), Mahogany (*Khaya senegalensis*) and Neem (*Azadirach indica A.* Juss.) Seeds from the Far-North Region of cameroon

Gilles Bernard Nkouam[1*], Balike Musongo[1], Armand Abdou Bouba[2], Jean Bosco Tchatchueng[3], César Kapseu[4], Danielle Barth[5]

[1]Department of Refining end Petrochemistry, Faculty of Mines and Petroleum Industries, The University of Maroua, P.O.Box. 08 Kaele, Cameroon, Tel: +237 696 33 85 03 / 662 999 397, email: gillesnkouam@yahoo.fr
[2]Department of Agriculture, Livestock and Derived Products, National Advanced Polytechnic School of Maroua, The University of Maroua, P.O.Box 46 Maroua, Cameroon
[3]Department of Applied Chemistry, National Advanced School of Agro-Industrial Sciences, The University of Ngaoundere, P. O. Box 455 Ngaoundere, Cameroon
[4]Department of Process Engineering, National Advanced School of Agro-Industrial Sciences, The University of Ngaoundere, P. O. Box 455 Ngaoundere, Cameroon
[5]Laboratoire Réactions et Génie des Procédés UMR CNRS 7274 ENSIC-INPL, 1, rue Grandville BP20451 54001 Nancy, France
* Corresponding author

Abstract—*An investigation was carried out in four localities of the Far-North of Cameroon (Maroua, Mokolo, Kaele and Yagoua in order to improve endogenous methods of oil extraction from kapok (Ceiba pentandra Gaertn.), mahogany (Hhaya senegalensis) and neem (Azadirachta indica A. Juss.) seed. The questionnaire administered to 75 traditional producers permitted us to note that extraction of oil from kapok is scarce. The traditional extraction processes from these oilseeds vary. But two principal techniques are predominant: the kneading process and the heated paste process. Husking, pounding and extraction make up the bottleneck. The yields are low, averagely six pans (of 1L capacity) are used to obtain one litre of oil. Amelioration of these methods through the introduction of grinders and pressers will not only help reduce strenuousness, but also increase the capacity to treat the yields and oil quality*.

Keywords— Azadirach indica A. Juss., Ceiba pentandra Gaertn., Far-Nord Cameroon, Khaya senegalensis, oil extraction method.

I. INTRODUCTION

Kapok (*Ceiba pentandra* Gaertn.), mahogany (*Khaya senegalensis*), and neem (*Melia azadirach L.* Inde) oils are known to possess nutritional, medicinal and cultural properties. They are used as a mixture or individually. Locally, these oils serve in the treatment of various diseases such as constipation, diarrhea, malaria, typhoid, worms and hemorrhoids [1, 2]. Neem oil is equally applied as a pomade to treat "getti getti" [3, 4]. Concerning bio-control in grain storage, they function as insecticides, protecting crops [4]. Kapok oil is mostly used during massages, to treat rheumatism and wounds [5]. It acts as an engine lubricant, as a raw material for soap production and as fuel for lamps [6]. All these virtues make these oils to become highly demanded and income generating. Hawkers sell these oils in town. But, the requests essentially come mainly from the meridian part of Cameroon and from neighbouring countries.

One constraint to this sector seems to be the artisanal extraction of these oils whose yield is low and cannot meet up with increasing demands. In fact, the raw materials are truly available, at least during the production season. Knowledge of the extraction processes becomes necessary in order to understand the mentioned techniques and the constraints that can be taken away so as to ameliorate extraction yield and extracted oil quality. To the best of our knowledge, studies on the description of traditional methods of extraction of these oils are almost no-existent. [5] Presented two extraction processes

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of kapok oil in Garoua (North) and in Mindif (Far-North). But this research was not focused on the entire Far-North.
The aim of this research is to investigate the different methods of extraction of oil from these three oilseeds in the Far-North in order to know their production and quality constraints.

II. METHODS

A preliminarily tested questionnaire was used to obtain information on the description of the methods of oil extraction. The questionnaire was administered to selected producers in the localities of Maroua, Mokolo, Kaele and Yagoua (table 1). These localities correspond to the administrative centres of Diamare, Maya Tsanaga, Mayo Kani and Mayo Danay divisions, respectively. The choice of these localities was drawn from locally obtained information and from preliminary tests which present these localities as areas of high production of these oils. In each locality, at least 10 persons were randomly chosen and interviewed.
The questionnaire comprised general information on the respondent (age, sex, region, division and village), methods of fruit treatments and information on the oil from the seeds (extraction techniques, uses and appreciation).
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Table 1: *Number of interviews per area*

Region	Town / village	Number of interviews
Far North	Maroua	11
	Kaélé	22
	Mokolo	20
	Yagoua	22
Total	**4**	**75**

III. RESULTS AND DISCUSSION

The processes for traditional oil extraction from kapok, mahogany and neem are numerous and diverse (fig. 1 to 17). We notice from the present investigations that the methods of extraction of oil from kapok show some subtlety (fig. 17) as compared to those obtained by [5]. Thus, after paste heating, the oil filtration step has disappeared in the actual process. Moreover, the scarceness of traditional methods of transformation kapok grains into oil is justified on one hand by the fact that this practice has been abandoned by the producers and on the other hand by local beliefs. In effect, in Kaele, for example, the producers say these trees harbour spirits that should not be disturbed.
These oils are generally extracted in the dry season and the process varies from one division to another, village to another, tribe to another. However, we can summarise them into two principal processes: the kneading process and the paste heating process.
The first technique uses hot or cold water as an extraction vector. In spite of a few hues, it can be summarised into the following operations: seed picking, husking, pounding, kneading and boiling of the oil. Fig. 1 to 8 present the charts applied in the towns of Maroua, Mokolo, Kaélé and Yagoua.
The second technique consists of heating the paste made out of the seed in such a way that the overlying fatty material can be recovered. It comprises the following principal operations: seeds picking, roasting, husking, pounding and paste heating. Fig. 9 to à 17 present the charts applied in the study area.

a. Seeds picking

Due to their heights, the grains are picked up. For the kapok tree, the fruits fall by themselves during the dry season then the grains can be selected and used. The same goes for mahogany where the dry grains are picked up. The neem grains are picked up fresh or dry. This step can be done either in open spaces or besides houses where these trees grow.

b. Roasting

Roasting is done by burning out the picked grains in order to facilitate husking and to make the oil-producing cells to become fragile. To this, a worn out metal sheet can be used or even dry straw from trees can be used. In this way, the grains are placed on a sheet under which a fire blazes. The crackling nature the grains develop indicates the end of the operation. The grains can also be wrapped up in dry straw and the whole thing burnt up. The roasted grains can then be husked.
However, the roasting conditions (temperature) may have negative effects on the variability of the organoleptic and sensorial qualities of the oil.

c. Husking

The shells of the seeds are removed to obtain kernels. This operation is done manually. Husking is done by passing a stone or stick over a bag containing the roasted grains. In all the cases, the sand and ash residues are separated from the seeds by winnowing.
In some processes, the seeds obtained (neem) are washed and dried before grinding takes place. Sometimes, the seeds are simple dried in order to facilitate the next step which is pounding. Drying is by exposing the seeds to sun for a duration that depends on the sun's intensity without exceeding one day.

d. Pounding

This is the step where the seeds are fragmented with the aim to facilitate the next steps. The seeds are pounded in a mortar with a little pestle. The final product is relatively crude. The granulation of the seeds is as reliable as dry.

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When the granulation of the seeds is not satisfactory, certain variants give a fine texture. That is, pounding is done a second time to obtain a finer powder. This facilitates the bursting of the oil-producing cells and prepares the way for extraction. This operation is very laborious and requires much muscular strength from the operator. The powder obtained is ready for the extraction step.

e. Extraction proper

This can be carried out either by kneading or by hearting the paste.

During kneading the finely ground kernels are placed in a clay pot in which water is progressively added. The water can be cold, warm or hot. The operation takes place at room temperature and during the dry season. Water is thus added as time goes by while stirring until an oil/water emulsion is obtained. The fatty matter is collected at the surface. This operation goes on until the paste becomes whitish. The quantity of water is not specified. Make sure during kneading, the paste is neither too thick nor too light.

Paste hating consists of heating the powder obtained mixed with water. The amount of water added is fundamental because the paste must remain thick, adding about one litre per pan (of 1L capacity). One of the additives used in the process is Rock-salt commonly called in the area "*Dalang*". This additive is said to be the agent that causes the oil to be liberated. This additive is only used to extract mahogany oil. As for neem oil, things like garlic are added in an attempt to take away the pungent odour. Oil is collected by hand exudation. The oil that becomes limpid is removed and allowed to settle. Opposite to the oil obtained by kneading, it is the rest of the paste that is made void of its oil by adding water and cooling. In this method, temperature is higher.

f. Boiling the oil

This operation is done by boiling the oil obtained in a clay pot or a pot in order to evaporate water. Certain variants go further to do an additional decantation which helps separate the oil from residual impurities. Oil is collected in recipients and is ready for conditioning. The methods of conditioning are numerous and diverse. We generally see conditioning in plastic bottles (35 millilitres and 1litre). But the extracted oil is immediately sold because generally, bookings for the oil are made way before production.

Considering the exploitation scale, the yields are very low. The instruments used for measuring raw materials (pans, calabashes) are local instruments. Globally, six pans of grains permit that one litre of mahogany and neem oil be obtained. In order to have one litre of mahogany oil in Kaele, three 10 kg (rice bags) need to be treated. Some producers use ten calabashes for one litre. In Yagoua, three calabashes of neem seeds and ten calabashes of mahogany seeds give one litre of the corresponding oil. In Mokolo, most of the women use three calabashes of neem and mahogany seeds to obtain one litre of oil. This is the same thing for Maroua. These yields are not far from those found in literature. In fact, 30 kg of neem fruits provide 13.6 kg of seeds, giving 3.75 litres of oil obtained by local pressing methods [4].

The Price for one litre of oil from these oilseeds varies in the market between 3000 and 6000FCFA. In the meantime, this price can rise to 12000FCFA in the rainy season or when the production of the grains has been low.

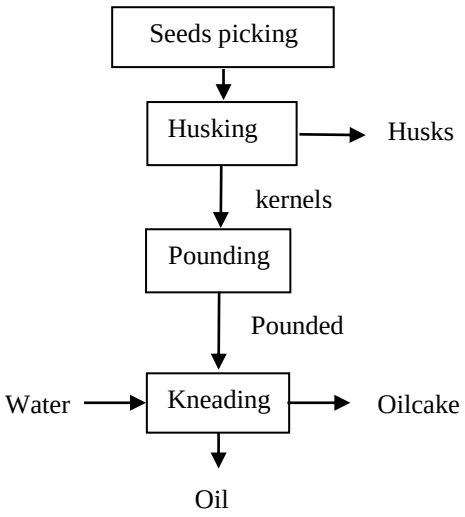

Fig.1: *Chart 1 for the extraction of neem oil in*

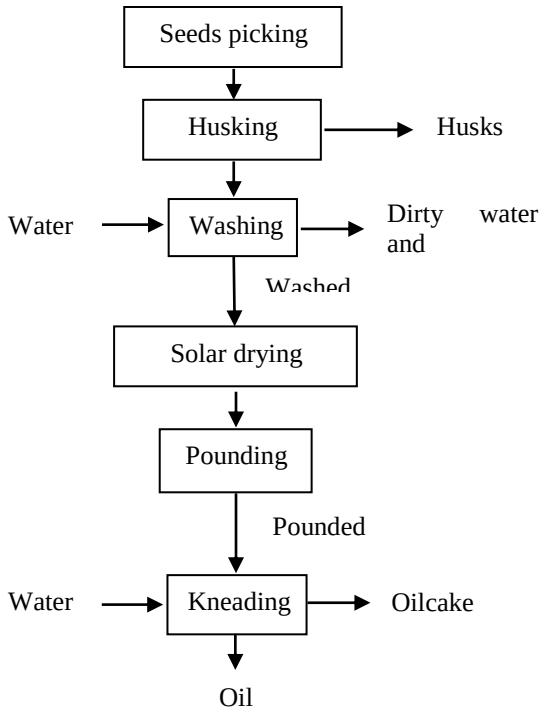

Fig.2: *Chart 1 for the extraction of neem oil in Mokolo*

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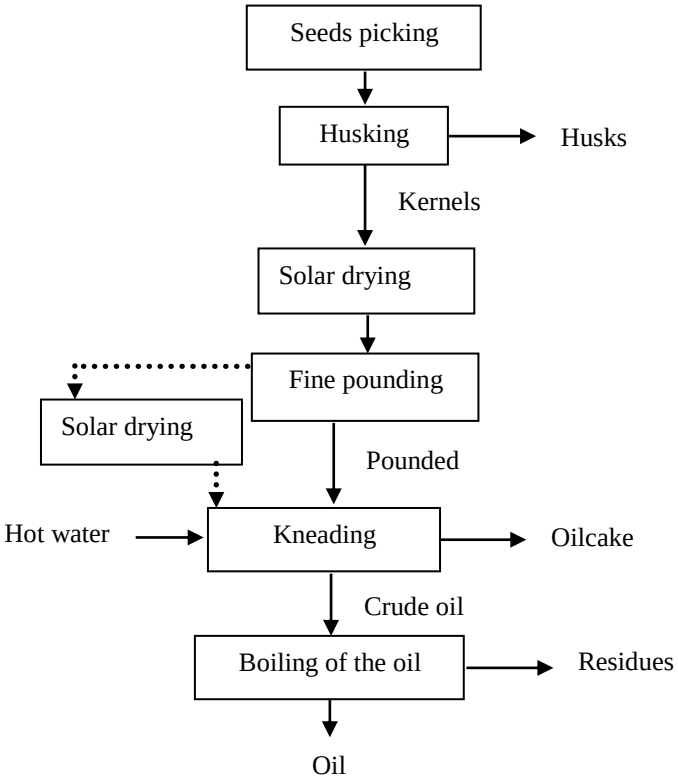

Fig.3: *Chart 1 for the extraction of neem oil in Kaele*

If the powder is not dry enough

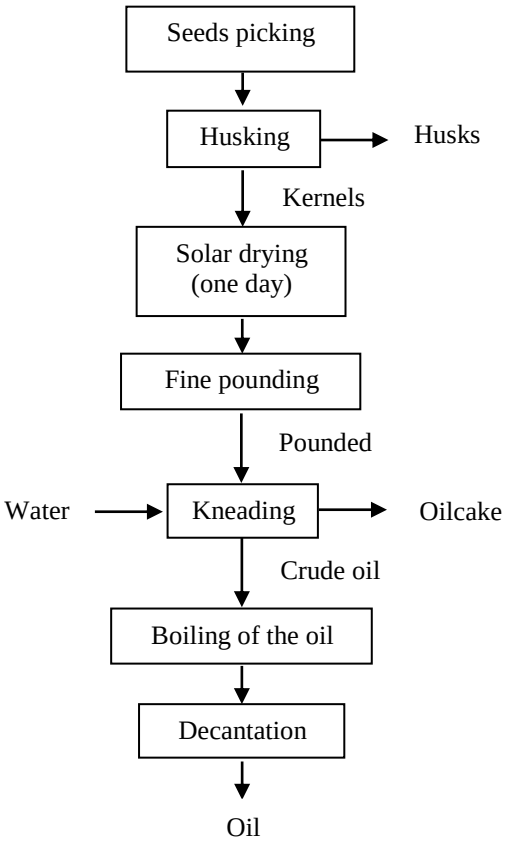

Fig.5: *Chart 3 for the extraction of neem oil in Kaele*

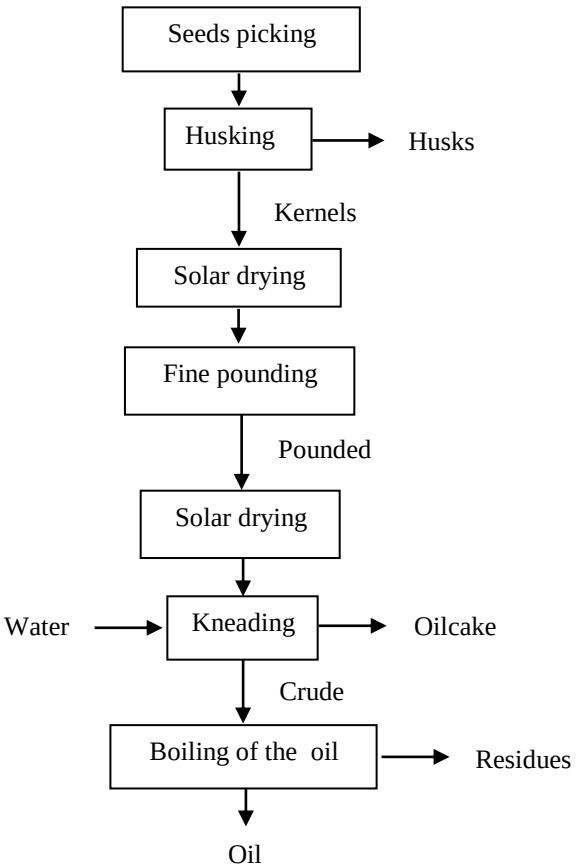

Fig.4: *Chart 2 for the extraction of neem oil in Kaele*

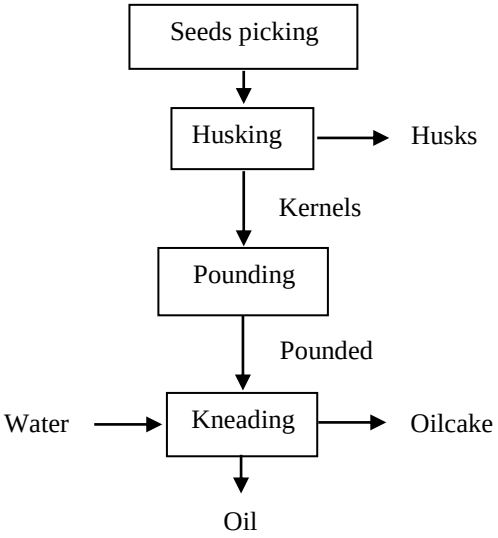

Fig.6: *Chart 1 for the extraction of neem oil in Yagoua*

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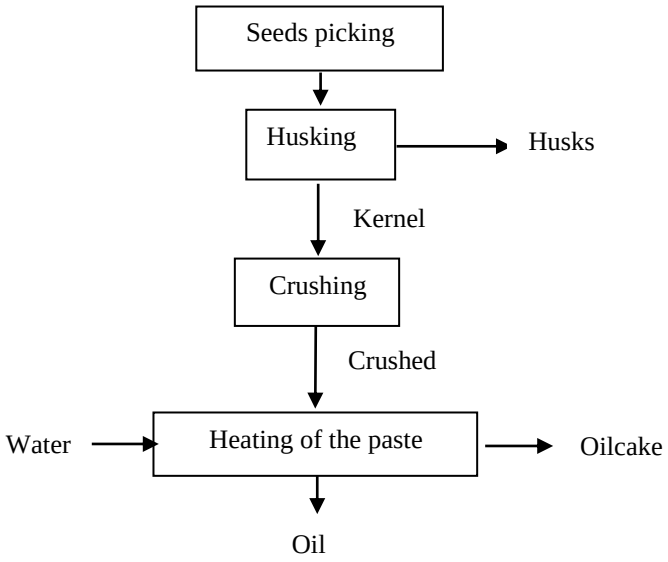

Fig.9: *Chart 2 for the extraction of neem oil in Maroua*

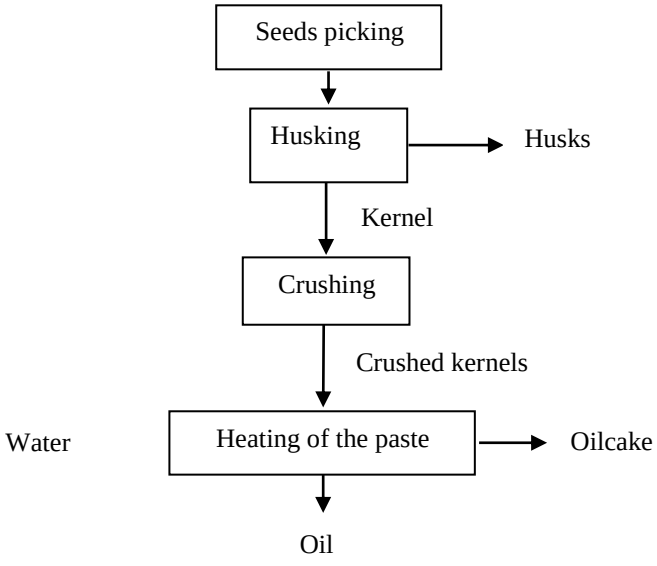

Fig.10: *Chart for the extraction of mahogany oil in Maroua*

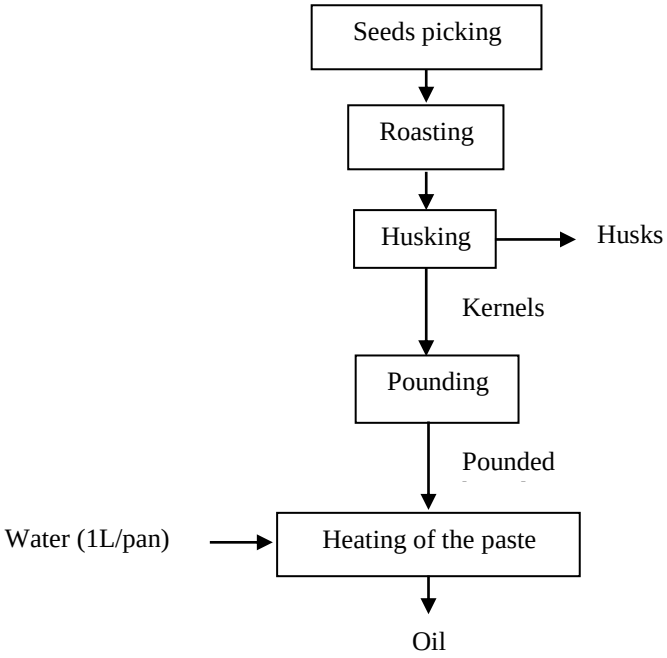

Fig.11: *Chart 2 for the extraction of neem oil in Mokolo*

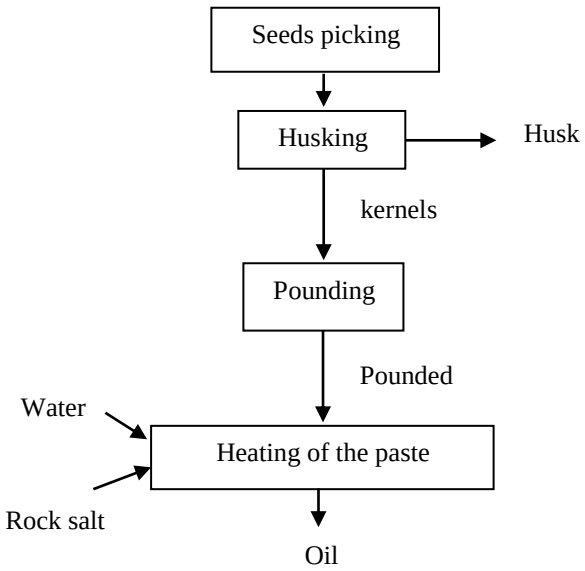

Fig.12: *Chart for the extraction of mahogany oil in Mokolo*

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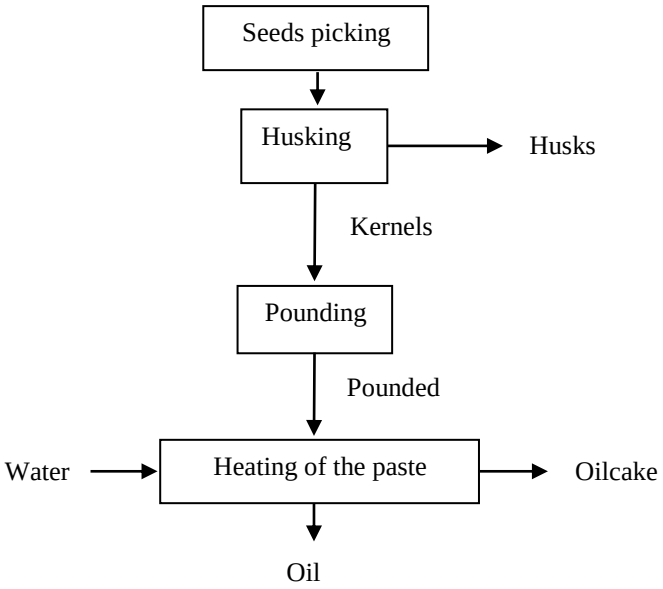

Fig.13: *Chart 3 for the extraction of neem oil in Kaele*

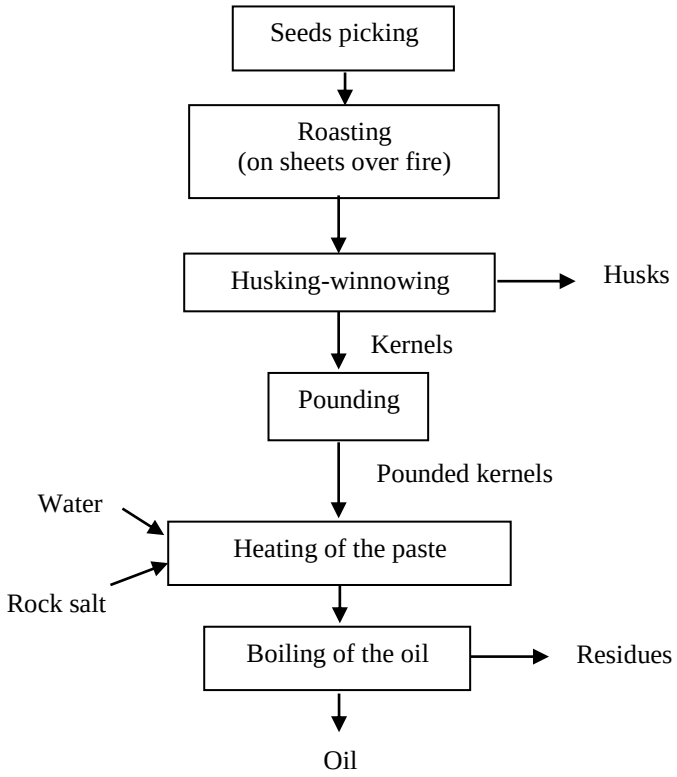

Fig.14: *Chart 1 for the extraction of mahogany oil in Kaele*

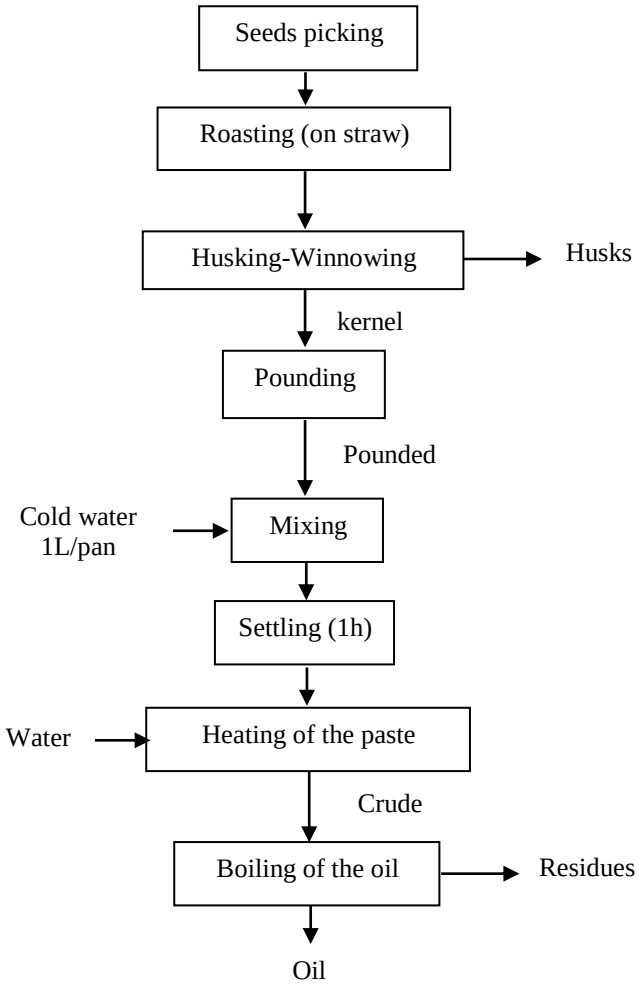

Fig.15: *Chart 2 for the extraction of mahogany oil in Kaele*

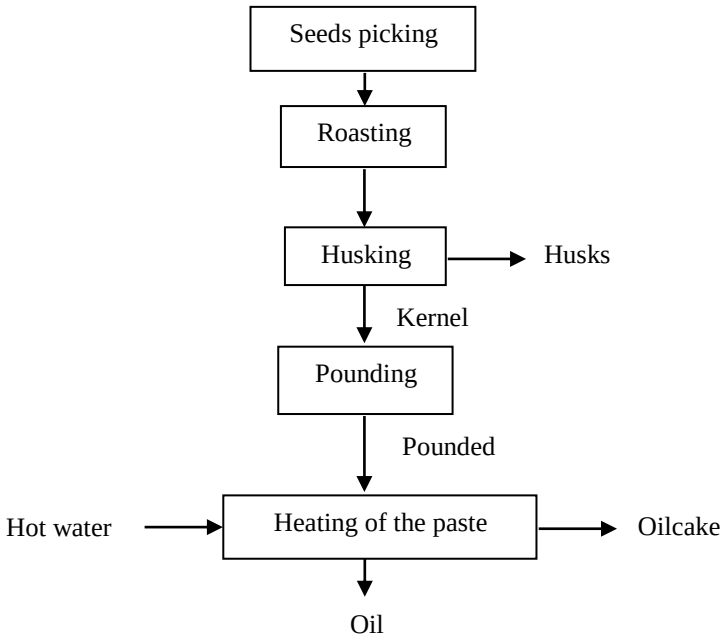

Fig.16: *Chart 1 for the extraction of mahogany oil in Yagoua*

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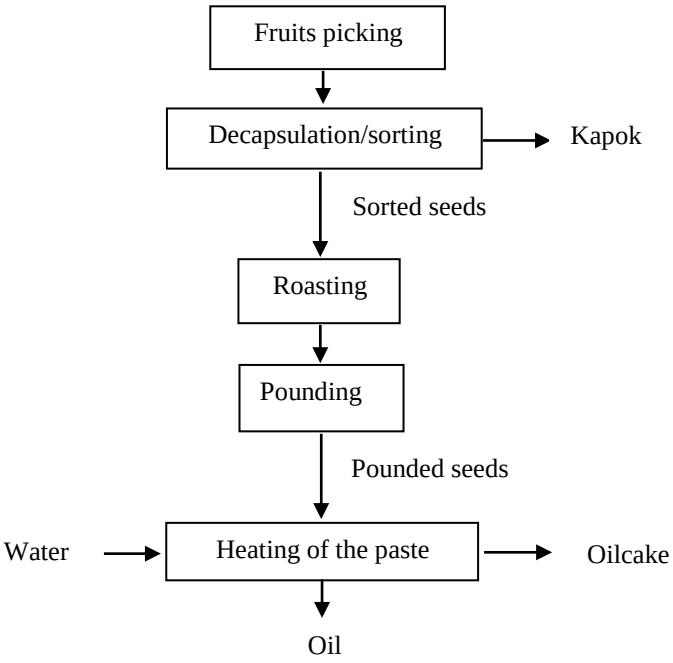

Fig.17: *Chart for the extraction of kapok oil in Maroua*

IV. CONCLUSION

A questionnaire administered to traditional producers of oil from kapok, neem and mahogany in four towns of the Far-North permitted the description of the traditional extraction processes of these oils. The processing of kapok grains into oil is scarce. The processes for traditional extraction of these oils are numerous and vary. Two principal techniques are found in all the investigated towns. That is the kneading process and the paste heating process. Husking, Pounding and extraction are the most tedious steps. Despite the increase in the demand for these oils, the yields are still low, averagely six pans of grains to produce one litre of oil. These extraction methods can be ameliorated by introducing crushers and pressers. This will help reduce tediousness, increase the capacity to treat, the yields and the quality of the oils.

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