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# Starch Extraction and Evaluation from Date's Seeds

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**Abstract:- The chemical, functional and physio-chemical properties of date seeds starch which has been isolated by three different starch extraction methods were examine in this study. The starch has been extracted by means of distillation, alkaline and sedimentation method of starch extraction. The outcome of different starch extraction method was evaluated in terms of its morphological features, starch yield percentage and some physicochemical properties. Starch extracted via alkaline method was parchment in colour and more desirable in terms of appearance as compare to Starch extracted via distillation having copper red colour and sedimentation method having brown sugar colour. The starch yield percentage was also high in case of alkaline method than distillation and sedimentation extraction method.**

***Keywords:-*** *Antioxidants, Vaporizations, Physicochemical properties.*

## I. INTRODUCTION

Many seeds from fruits are generally being discarded as a waste product during the processing and production of beverages, squashes, jellies, wine etc. The higher production of waste seeds is making it affordable and easily available material for the starch isolation. Seeds are generally rich in complex polysaccharide, phytochemicals and antioxidants which can be used for the production of preventive and curative function foods.The Micro and macro-nutrients as well as phytochemicals present in the seeds can be used for the different purpose and for its modifications in different ways. Valorization of those waste seeds is helpful in reducing environmental pollution and utilizing it for the better purpose.The starch of seeds can be used as for food supplements, pharmaceuticals and textile purpose and for many different applications. So, in this research plan, Valorization of seeds from dates is going to happened. Dates or Dates palm (***Phoenix dactylifera)*** belongs to the family Arecaceae. It is majorly cultivated across Northern Africa, Middle east and south Asia. (Wikipedia). Dates is National fruit of UAE. Due to current uncertainty in the world food supply, the dates palm provides a good source of low-cost food. The production of dates world-wide has increased from about 4.60 million tonnes in 1994 to 6.9 million tons in 2004 (FAO, 2007). Egypt, Saudi Arabia, Iran and Iraq and the main predicting countries.In India, the cultivation of dates palm was started in 2007. The Kutch district of Gujrat is the most cultivated area of dates with about 18286 hectares with the annual production was about 171522 metric tons during initial stage in year 2014. Dates consist of about 70% of Carbohydrate which is mostly in the form of sugars. This sugar content is almost completely invert sugar, so it gets quickly absorbed by the human body (Al-Hooti*et al.,* 1997; Myhara*et al.,* 1999). Dates also consist of large content of dietary fibres and also a very good source of few micronutrients especially minerals e.g., Calcium, Iron as well as Potassium. The seeds of dates are very rich in potassium 350-400 mg/100g, Phosphorus 200 mg/100g, magnesium 70mg/100g and calcium 40mg/100g and smaller extent iron 10-20mg100g (Al-Shahib and Marshall 2003; Nehdi*et al.,* 2003; Al Juhaimi*et al.*,2012.

The main functional content of dates is its dietary fibers content which is very essential for the gut health. Dates are also rich in antioxidants which prevents our body from free radicals which may cause harmful effects and so disease. Most potent antioxidants in the dates are Flavonoids, Carotenoids and Phenolic acid. These antioxidants act as anti-inflammatory and reduce the risk of cancer, Alzheimer's disease, heart issue, diabetes etc. So many recent studies illustrated that apart from dates it's seeds also consist of high amount of antioxidants, phenolics as well as dietary fibers even more than those present in the date flash (Hamada *et al.,* 2002; Al-Farsi *et al.,* 2007). As per the Free-radical theory of aging, food products consisting antioxidants like vitamins or polyphenolic components will decrease or reduce the oxidative processes and damage caused by the free-radicals which generally contributes to many age-related degeneration and disease (Manach*et al.,* 2004; Fernandez-Panchon*et al.,* 2008). Due to high content of antioxidants, Date seeds were tested for their health benefits. The male rats were being fed diet consisting around 70-140g/kg date seeds continuously for 30 days (Habib and Ibrahim 2011). Symptoms of Oxidative damages were evaluated in the liver and serum and the status of antioxidants were evaluated in the liver. The outcome reveals that date seeds notably reduced liver as well as serum malondialdehyde (a lipid peroxidative damage product) and serum lactate dehydrogenase (high LDH is indicator of tissue damage) and creatine kinase. On the basis of this outcome, Habib and Ibrahim concluded the protective effect of dates seeds over oxidative damage, mainly due to the action of bioactive antioxidants present in the seeds.

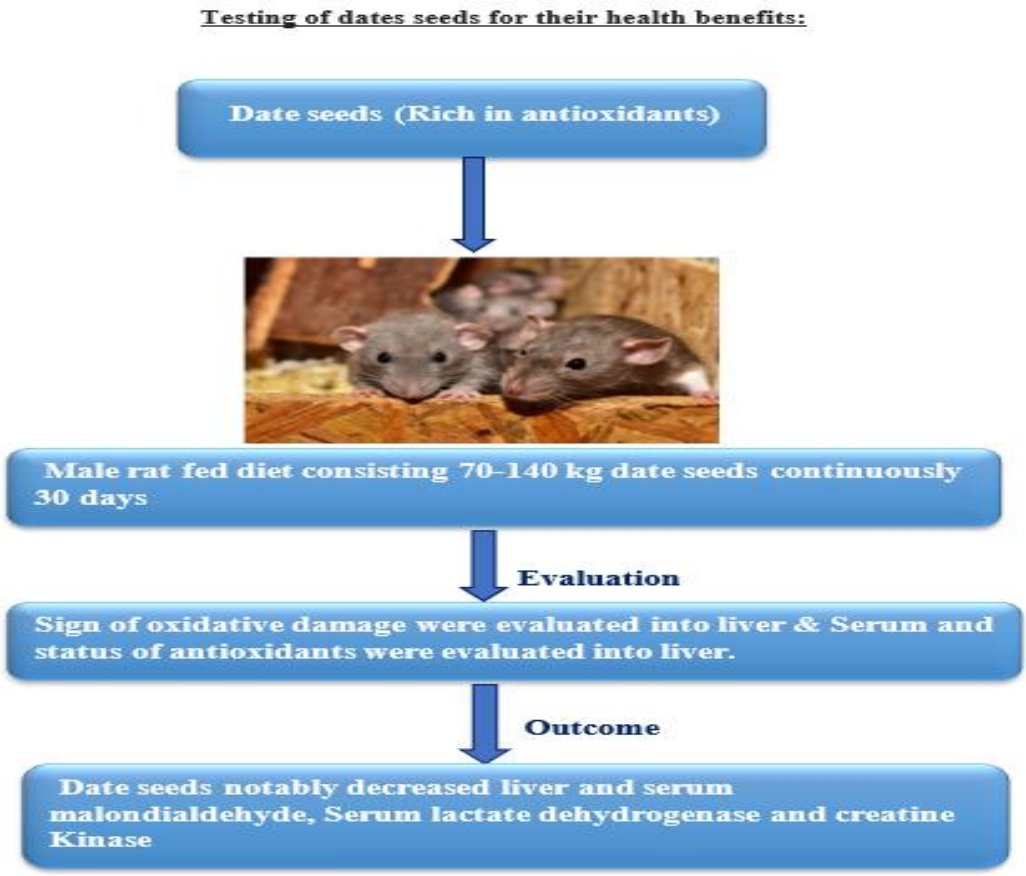


Image 1

These health attributes are the main reason for the valorisation of date's seed and starch extraction and utilization for the many purposes in the food industry. The extracted starch could be used for many industrial purposes such as production of pharmaceuticals, function foods, thickening or gelling agents as well as it has film-forming properties (Gebre and Schmidt,1996; Alabi *et al.,* 2005).

## II. EXPERIMENTAL STUDY

*A. Collection of sample and seed treatment*

For this research purpose dates were acquired from nearby local market. Then seeds were separated from the pulp and washed with tap water to eliminate all the impurities. After sun-drying for 2 days, it was kept into hot air oven at 70˚C whole night for its proper drying. The dried seeds were grinded to obtain seed's flour. The flour was then sieved with the help of sieve (450-550 µm mesh). It was then sealed packed into an air-tight plastic bag and stored into a refrigerator at around less than 5 ˚C till further used for the isolation of starch.

A. Raw Dates B. Dried Seeds C. Date seeds flour

Image 2: Formation of date seeds flour

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*B. Extraction of date's seeds starch by Distillation method.*

The starch from date's seeds flour extracted as per the isolated as per the procedure explained by Noor *et al* with some modifications. At first, 5g of date's seeds flour were added on 100 ml of distilled water and put this beaker on magnetic stirrer to get this sample stir continuously for around 6 hours at normal room temperature. Proceeding further, the prepared slurry was separated using a cloth bag and the remaining persisted residue were cleaned 3 times with distilled water. Now the filtrate was kept for precipitation whole night at 4 ˚C. the isolated starch was then kept into hot air oven at 80 ˚C overnight. This starch was then sealed packed in an airtight plastic bag and kept for further use at normal room temperature.


A. Sample in Magnetic Stirrer B. Extracted Starch C. Dried date seeds starch

Image 3: Isolation of starch from date seeds by means of distillation method

*C. Extraction of date's seeds starch by Alkaline method*

The extraction of starch from date's seeds flour was done using the procedure performed by Noor *et al*. First of all, 5 g of date's seeds flour was put into 0.5% concentration of Sodium Hydroxide (NaOH). This sample was then kept on magnetic stirrer to get it stir continuously for 6H at normal room temperature. Then again, the slurry was filtered with the help of cloth bag. The remaining residue were cleaned 3 times with the distilled water. It is then kept into the freezer at around 4 ˚C to precipitate overnight. In the end, the obtained starch was kept for drying in hot air oven for overnight at 80 ˚C. The prepared starch was then sealed in a plastic bag and kept for until use at normal room temperature.


A.O.5% Conc NaO B. Sample in Magnetic stirrer C. Extracted starch D. Final product

Image 4: Extraction of date seeds starch by means of Alkaline method

*D. Extraction of date's seeds starch by Sedimentation method*

The starch from date's seeds flour was extracted using the procedure of Oates and Powellbut with some modifications. 50g of date seeds were kept in a glass of water overnight. It was then cleaned and grounded in mortal pestle and then in blender. Proceeding further the slurry was strain through cloth bag. The strained supernatant was kept for sedimentation the starch. This sedimented starch was again slurry in distilled water and then re-sedimented three-four times. Finally, the starch was kept sedimented in 0.1M Sodium Chloride (NaCl) and 1/10 volume of toluene for approx. 3 hours and then it was properly washed with the clean distilled water and kept into the hot air oven overnight at 60 ˚C for drying. This starch was grinded in a mortar & pestle then sealed packed in an air-tight plastic bag. This is then kept in normal room temperature for until use.

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A. Toluene B. Sample for sedimentation C. Extracted starch D. Final Product

Image 4: Isolation of date seeds starch by sedimentation method

## III. CHARACTERIZATION AND EVALUATION OF EXTRACTED STARCH

### A. *Starch Colour*

The difference in colour of starch extracted from Distillation, Alkaline and Sedimentation methods has been evaluated directly by seeing the result.

### B. *Starch Yield*

The extracted starch yield percentage from three different methods was calculated using formula given below according to Noor *et al.*

$$\text{Starch yield (\%)} = \frac{Intial\ weight - Final\ weight}{Intial\ weight} \times 100$$

### C. *Determination of Proximate analysis*

AOAS method (2000) was used to estimate the Moisture content, Ash Content and Fat Content of the extracted starch from date's seeds flour. This testing has been done at the food technology lab of Sharda University.

### D. *Determination of Purity*

The purity of extracted starch has been determined by evaluating the difference between the starch yield along with the total content of moisture, fat and ash.

### E. *Determination of Water solubility Index and Water Absorption Index*

WAI as well as WSI has been evaluated according to the methodology explained by Andersson (2001).1g starch extracted from each method was steeped and suspended on 10 ml distilled water then kept stirring for around 30 min continuously. Proceeding further, the suspension was put into centrifugation at 4500 rpm for 40 min. The supernatant was transferred into already weighed petri dish. The remnants were finally weighed after getting dried in hot air oven overnight at 70 ˚C. The equation for measuring the WSI is mentioned below.

$$\text{Water Solubility Index (WSI)} = \frac{Weight\ of\ dessolved\ solid\ in\ supernant \times 100}{Weight\ of\ dry\ solid}$$

$$\text{Water Absorption Index (WAI)} = \frac{Weight\ of\ sediment}{Weight\ of\ dry\ solid}$$

### F. *Determination of SWC*

Swelling water capacity (SWC) was calculated as per equation used by Lai and Cheng (2004). 0.1g of starch extracted from all three method was heated into 15ml of distilled water at around 50-60 ˚C into a water bath for about 30 min with constant stirring. The sample were then centrifuged at 1600 rpm for around 20 min. The part which has been precipitated was weighed and then the swelling power or swelling water capacity was determined using the formula given below.

$$\text{SWC} = \frac{Weight\ of\ sediment\ part}{weight\ of\ sample\ (Dry\ basis)}$$

## IV. RESULT AND DISCUSSION

### A. *Morphological properties- Colour of Starch*

The difference in colour of starch extracted from the three different method such as Distillation method, Alkaline method and sedimentation method were analysed. The date's seed starch extracted by means of sedimentation method was in Brown Sugar (#E2A76F) in colour. In case of Alkaline method, it was Parchment (#FFFFC2) in colour. Whereas starch extracted by distillation method from date seeds was Copper Red (#CB6D51)in colour.

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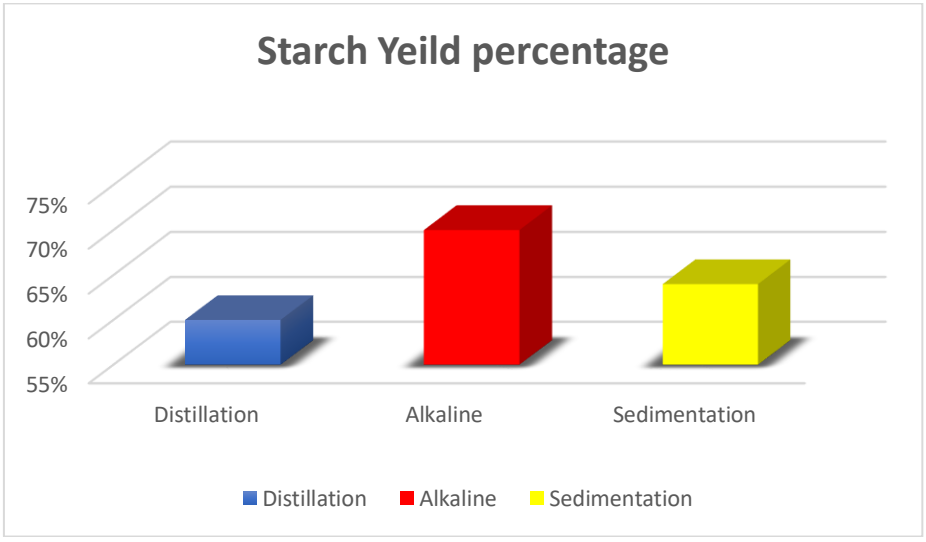
Image 5: Difference in colour of date seeds starch

*B. Starch Yield percentage*

Starch yield was calculated as Starch yield percentage according to calculation of Ratnayake *et al* (2007).

$$\text{Starch Yield (\%)} = \frac{Weight\ of\ isolated\ starch\ (g) \times 100}{Weight\ of\ date\ seeds\ flour.}$$

Starch yield percentage from date's seeds flour by means of Distillation, Alkaline and Sedimentation method was 60%, 70% and 64% respectively.




Graph 1: Difference in starch yield percentage

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*C. Moisture Content*

Moisture content was calculated as:

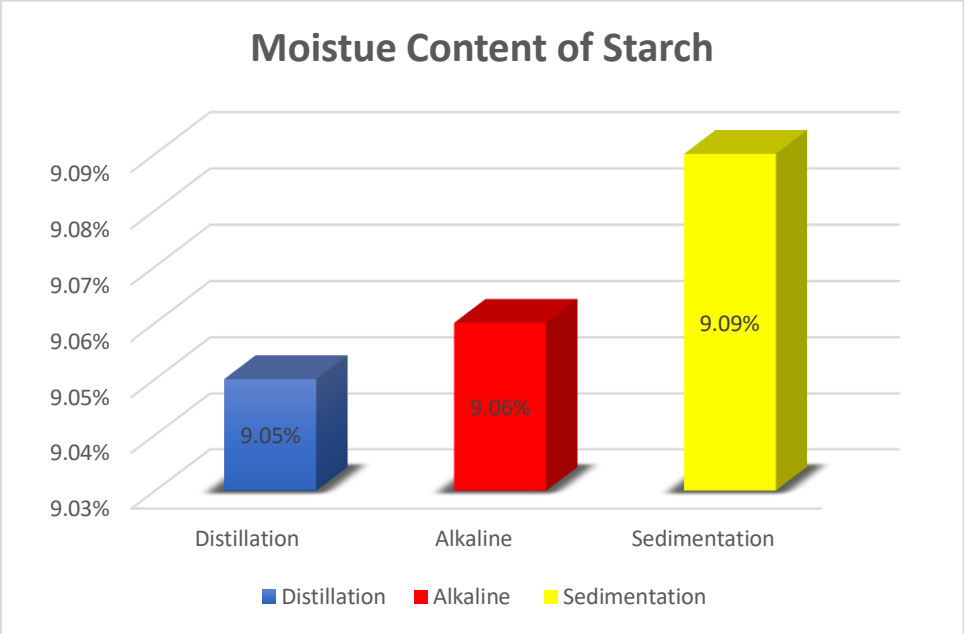
$$\text{MC \%} = \frac{Ws-(W2-W1)}{Ws}$$

Ws= Weight of sample

W1= Weight of dish

W2= Weight after drying

The moisture content of dates seeds starch by 9.05%, 9.06% and 9.09% by means of Distillation, Alkaline and Sedimentation methods. Starch extracted from sedimentation method has higher value of Moisture content as compere to Alkaline and Distillation.




Graph 2: Difference in moisture content of extracted starch

*D. Ash Content*

The Ash content was calculated as Ash percentage.

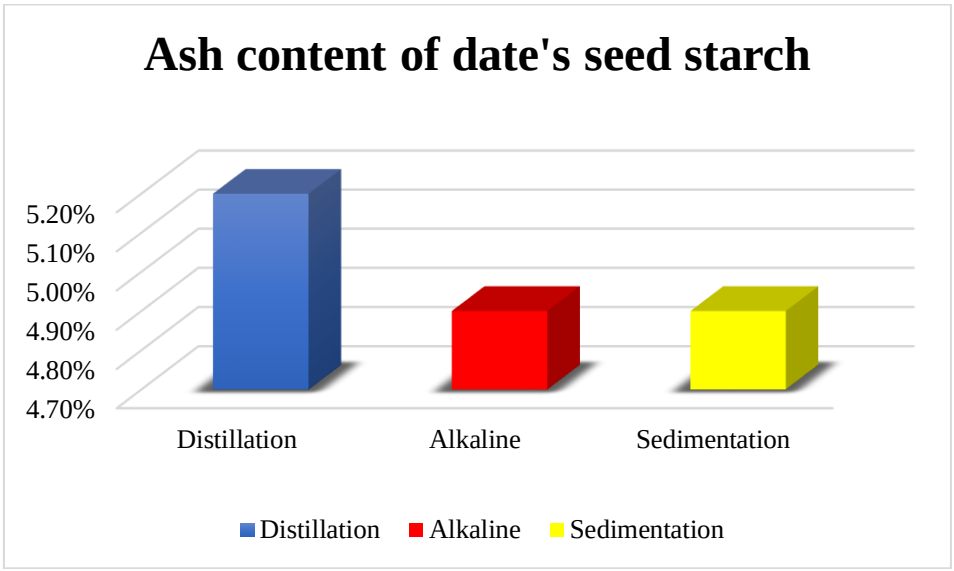
$$\text{Ash \%} = \frac{W2-W1}{Ws} \times 100$$

W1 = Weight of crucible

W2= Weight of crucible with ash.

Ws= Weight of sample

The ash content of starch isolated from date's seed were 5.2%, 4.9% and 4.9% from distillation, alkaline and sedimentation method.




Graph 3: Difference in ash content of extracted starch

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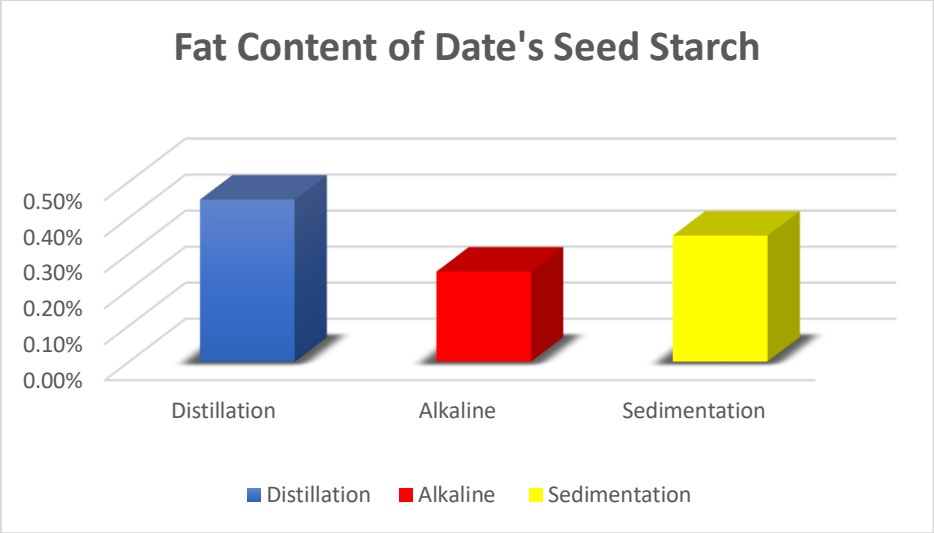
*E. Fat Content*

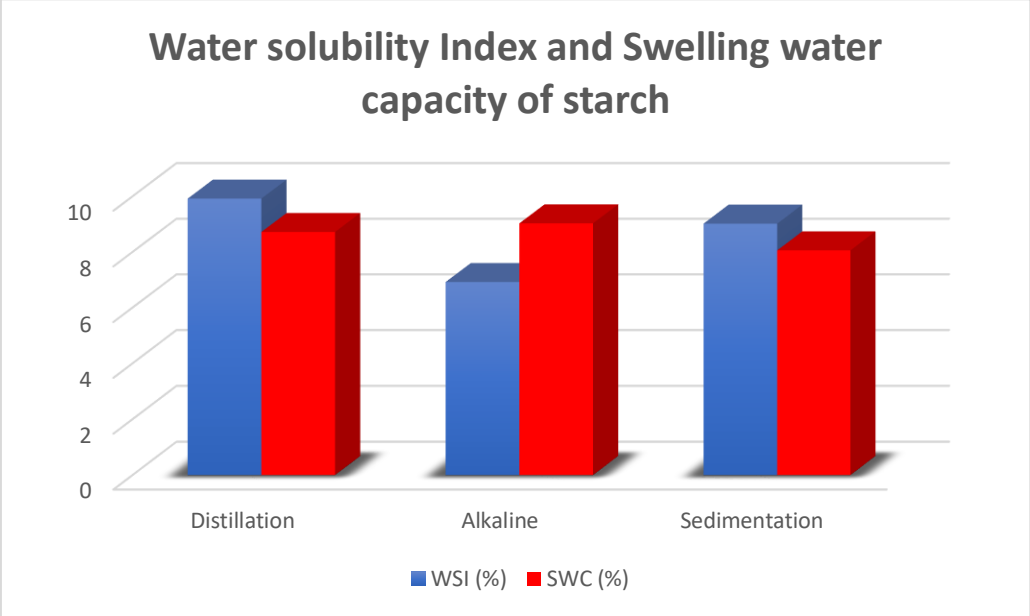
The fat content of 5g of date's seed starch extracted by means of distillation, Alkaline and Sedimentation was 0.45%, 0.25% and 0.35% respectively.




Graph 4: Difference in fat content of extracted starch

*F. Water Solubility Index and Swelling Water Capacity*

WSI and SWC is one of the essential functional properties of extracted starch. The starch extracted by means of distillation method had more (9.92%) WSI and compared to sedimentation (9.02%) and alkaline method (6.92%) of starch extraction. Whereas the swelling water capacity was more in case of alkaline method (9.03%) as compare to distillation method (8.72%) and sedimentation method (8.06%). The difference is value is mainly because the amount of difference in amount of amylose content.




Graph 5: Difference in WSI (%) and SWC (%)

So as per above Discussion, it has been analysed that the starch yield percentage is high in case of Alkaline methods of starch extraction whereas moisture content is case of sedimentation method. The Ash and fat content of extracted starch was more in case of distillation method of starch extraction.

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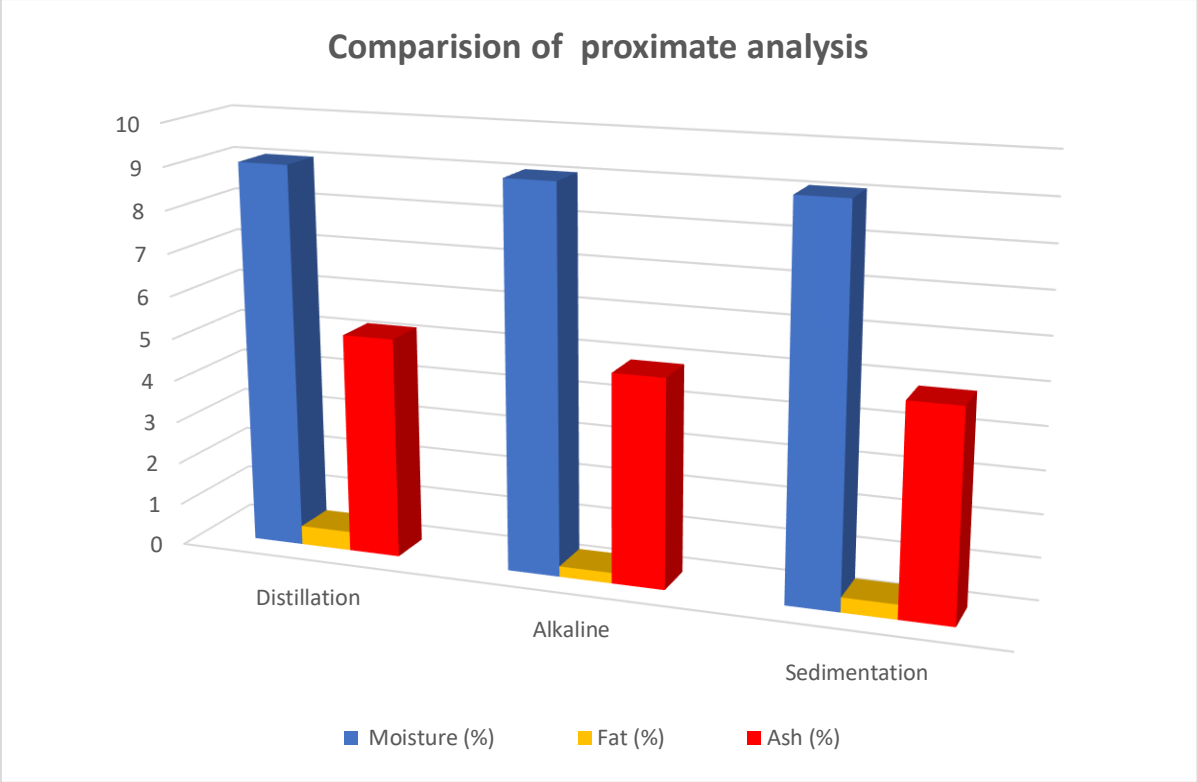
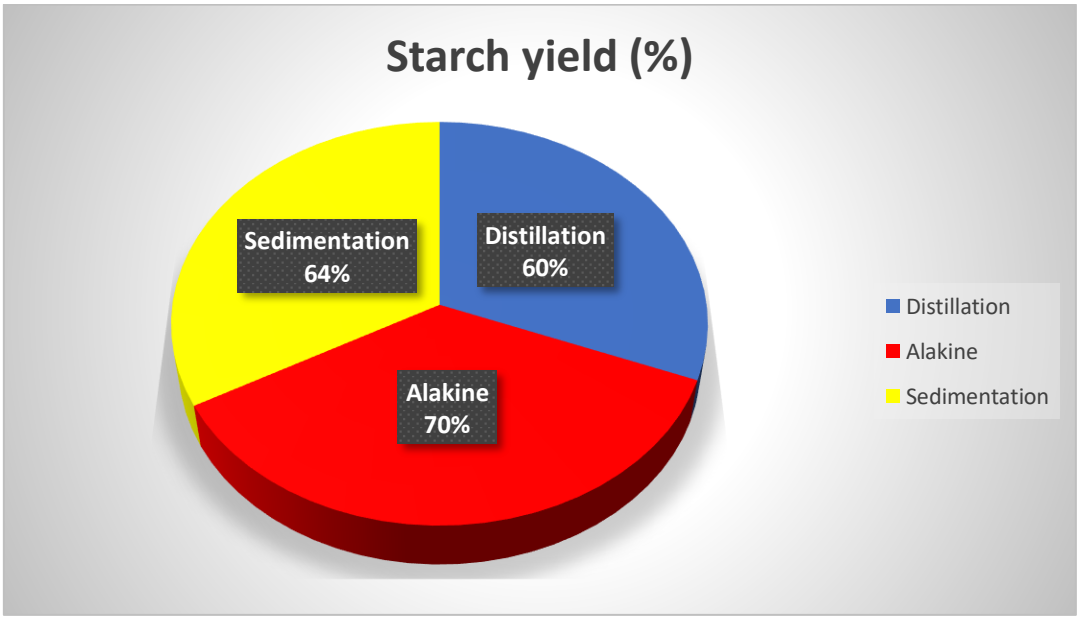
| Extraction Method | Starch Yield (%) | Moisture (%) | Fat (%) | Ash (%) | WSI (%) | SWC (%) |
|---|---|---|---|---|---|---|
| Distillation | 60 | 9.05 | 0.45 | 5.2 | 9.92 | 8.72 |
| Alkaline | 70 | 9.06 | 0.25 | 4.9 | 6.92 | 9.03 |
| Sedimentation | 64 | 9.09 | 0.35 | 4.9 | 9.02 | 8.06 |

Table 1: Difference in Proximate composition of starch extracted from three difference method




Graph 6: Comparison of proximate analysis of starch extracted from three method of extraction




Graph 7

## V. CONCLUSION

In this study, flour was prepared from date seed and then starch was extracted by means of distillation, alkaline and sedimentation method of starch extraction. The result showed that starch yield percentage was higher when extracted by means of alkaline method as compare to alkaline and sedimentation method. Whereas moisture content of extracted starch was more in case of sedimentation method. The ash content and fat content were highest in starch extracted from distillation method. As per the appearance of starch extracted from three different method, the colour of starch extracted by means of alkaline method was more desirable for application in the food industry. The overall result exposed that date seeds could be a good source of starch in terms of health benefits. It could be used for the formation and development of functional foods and supplements.

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