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Effect of hydrocolloids on microstructural properties of traditional snacks products

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Abstract
The purpose of this research is to study the effect of gaur gum and gum arabic on microstructure of the traditional snacks product. In this research raw material used as polished and unpolished black gram and chickpea for preparation of snacks products i.e. chakali and sev. By application of central composite rotatable design (CCRD) on gaur gum and gum arabic got optimized sample for preparation of snacks product. Scanning electron microscopy (SEM) used for study the internal structure of the snacks product. In microstructure study before and after frying results are interpreted with chakli and sev sample and observed the thin layer and smooth surface binding with starch and protein along with less oil absorption by the change in internal structure of snacks product.

Keywords: Hydrocolloids, microstructure, scanning electron microscopy (SEM)

1. Introduction
Chickpea flour is the main traditional ingredients in the preparation of chakli and sev. Black gram flour is blended with the chickpea flour for the intention of increased protein content as well as it contains less fat and has more binding property. Hydrocolloids such as gum arabic, guar gum are used decrease the fried product oil content. Chickpea was esteemed for its dietary seeds with 25.3 to 28.9 percent high protein content after the dehulling process (Hulse, 1991; Huisman *et al*., 1994) [3, 4]. The chickpeas contain decently at low fat substance at 6.48 %, unrefined fiber substance of 3.82 % dry premise and high accessible sugars at 50 % (Saleh *et al*., 2006) [6].
Guar gum has been either adjusted or unmodified it is an in all respects skillfully and productive common polymers covering various applications in different businesses like sustenance pharmaceuticals drinks beautifying agents paper development material oil and gas well boring mining industry. The natural attributes of guar galactomannan and other such polysaccharides were subject to their conduct in a watery medium individually. The guar gum swells or breaks down in polar dissolvable on scattering and structure solid hydrogen bonds. In non polar solvents it frames just feeble hydrogen bonds (Bemiller et. al., 1993) [2]. Gum Arabic is the resin of the trunk of the acacia signal tree alimentary sectary. The process of the gumminess and usually in the form of the last 3 to 8 week formation of the gum arabic. The traditional name of the gum arabic is the acacia and they are known as the signal.
The main area used for the formation gum arabic is north Sudan total 80% of production, advantage of the production of the gaur gum is export they have the major market in European area the export gives more profit to the gulf countries. The mechanism behind cholesterol lowering by guar gum is a result of enhances in the excretion of bile acids in faecus & lowers in entero hepatic bile acid which might get better the generation of bile acids at cholesterol hence hepatic no cost cholesterol focus continues to be lowered. Changing health trends and customer awareness leads to interest of researchers to produce low fat snack food. Varying ingredient in product with respect to the traditional ingredients and product preparation method may leads to formation of low fat snacks with high nutritious value.
RSM comes with a benefit of using it to decrease the number of experimental runs required for providing enough statistical acceptance information of the outcomes. There are two variants which are sometimes are known as variables (for each variable there are five levels) Central Composite Rotatable Experimental Design (CCRD) has been used (Montgomery, 2001) [5].
The purpose of this research is scanning electron microscopy **(**SEM) is capable for the resolve of the selected point on the food material i.e. approximately the position of the food material is determination by the scanning microscopy.

The capability of the scanning of the approximate part so the qualitatively analysis and semi qualitatively analysis is done by the microscope the purpose of this to identified the crystalline structure, magnification and method of orientation.

2. Materials and Methods

2.1 Materials: Chickpea flour (CF) (Besan) and Black gram flour (BGF) was added in different proportions. Two hydrocolloids are used individually namely guar gum and gum arabic.

The optimized sample are prepared after finalized all result and after interpretation got the optimized sample by the application of rotatable experimental response of design of RSM: Response Surface Methodology and it was utilized to optimize different levels of hydrocolloids like Guar gum and Gum Arabic to produce low fat content namkeen to have.

2.2 Method: Microstructure by SEM

2.2.1 Scanning Electron Microscopy (SEM)

In this instrument high energy electron generated beam producing a signal on the hard surface of the food product. These signals are produced from the interaction of the electrons and the sample including the determination of the morphology, chemical composition, crystalline structure and internal structure of the food material in which in the binding and amount of the raw material used even is identified. In this instrument the orientation of the food material is determination by the two and three dimentational properties of the food material.

The total are used for the approx determination of the sight is 1 cm to the 5 microns in width is scanned by the microscope and magnification range of th 20 X and upto the 30,000 X spectral resolution of 60 nm to 100 nm.

The SEM is capable for the determination of the selected point on the food material i.e. approximately the position of the food material is determination by the scanning microscopy. The capability of the scanning of the approximate part so the qualitatively analysis and semi qualitatively analysis is done by the microscope the purpose of this to identified the crystalline structure, magnification and method of orientation.

2.2.2 Principal of Scanning Electron Microscopy

The principal behind the scanning electron microscopy is formation of the electron at significant amount and form the kinetic energy and such signal are produced by the electrons interaction. The signals include secondary electrons, backscattered electrons, photons, visible light and heat. All these are used to the formation of the image sampling and showing the morphologically sample and producing the composite multiphase sample. X-ray producing the inelastic collision of the oriental atoms samples. The X-ray are producing the fixed wavelength on the product. The non destructive form of the rays are interaction on the volume of the sample, it is possible to the analysis of the material repeatability.

2.2.3 Essential Component of SEM

Source of electron discharge or Gun

Lenses, Sample collecting pot, Signal detector, Data display screen, Supporting rods

2.2.4 Structural need for the SEM development

Power supply, Vacuum supply, Cooling System, Vibration free floor, Ambient magnetic and electric field

2.3 Sample Preparation

Sample is prepared by the spider sputter coated in gold. Low voltage distribution of the droplets and transfer to the conductive coating applied and coating would alter fragile specimen stage they can prepared by the small enough spaceman stage and creating the electric conductivity withstand the high voltage condition and withstand at the high vacuum condition and high energy beam electrons. Sample generally mounted on the rigid specimen holder and stub using conduction adhesive. SEM used extensively to defect the data analysis using semiconductor wires manufacturing by the instruments any part of the 370 mm. Many instruments have chamber to support the sample and object is placed in the 45^{O} and continuous rotation at 360^{O} rotation.

Nonconductive specimen collects the charges and scanned the electron beam by creating the image mode this causing the scanning spots and especially the secondary electron mode is produced and caused the conventional imaging in SEM, specimen producing the electrical conductivity on the surface and prevents the accumulation of the electrical charge.

Metal objective is required for the special preparation of the SEM except the cleaning and mounting the subject on the stub. Non conductive material is coated with the ultra thin coating and mounting material deposited on the sample either by vacuum production with the help of the vacuum pump and sample is present in vacuum.

2.4 Application

The SEM used to the high resolution image object and spectral variation in the chemical composition: 1) Used the elemental maps to design using the SEM. 2) Discrimination of the different phages of the atomic number by using SEM. 3) Differential maps for the determination of the activators. The SEM is most widely used for the qualitatively analysis and the crystalline structure. SEM connected with the different types of instruments like backscattered electron detector and examine by the micro fabric.

2.5 Limitation

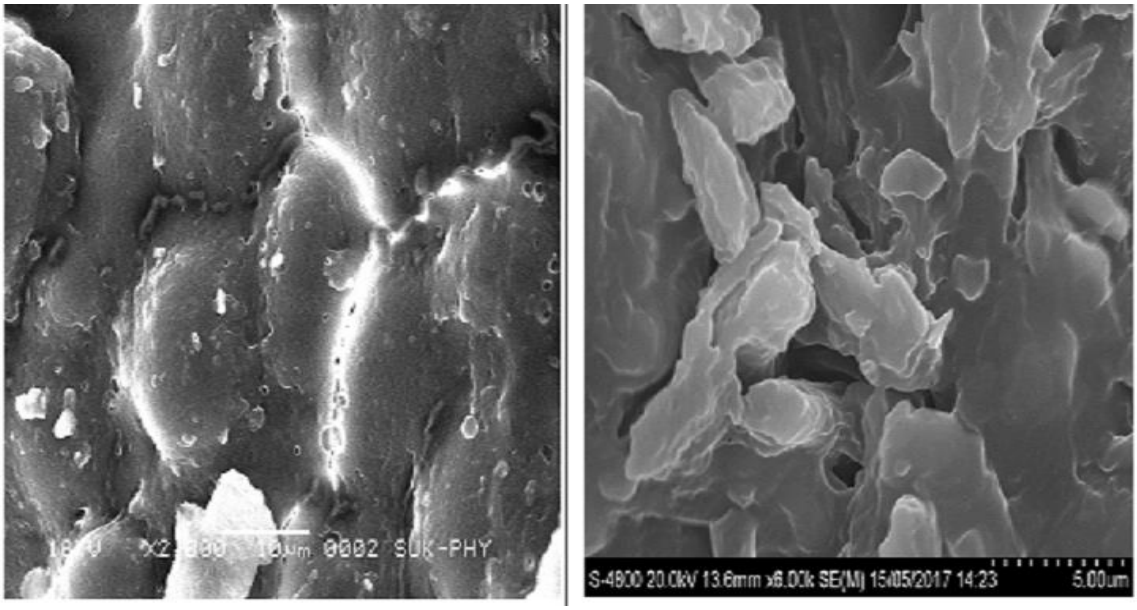
Sample must be in sold form is the limitation of this machine and it must be fitted in the solid chamber. Maximum size of the SEM microscope is horizontal and diameter is order of 10 cm, vertical diameter is exceeding the 40 mm. The vacuum production the instrument is 10^{-5} and 10^{-6} torr. Sample is low pressure and made up of the wet and coal, organic material or swelling clay sample likely to the determination of the examination of the conventional SEM method. The method of detection of the microstructure cannot detect the hydrogen, helium and lithium and many instruments not detect the sodium also by using X-ray it is detected.

3. Results and Discussion

Microstructure research has important part in the detailed understanding of several food phenomena which arise during frying tasks. In the last several years, the microstructure of foods is thoroughly studied considering that lots of crucial phenomena which limit the attributes of foods arise beneath the various µm machine. Thus, foods system in the micro or maybe macro scales plays a crucial part of mass transfer procedures including drying out (Aguilera, 2005) [1].

The study was carried to investigate the potential use of hydrocolloids and their effect on microstructural properties of

snacks product. The use of gaur gum and gum arabic in both the snacks product chakli and sev and observed the effect of hydrocolloids before frying the product and after frying the product and it is interpreted as below in figure 1 for chakli and figure 2 for sev.



(a) Before frying chakli (50:50 black gram and chick pea flour) and gaur gum 1.45 gm, gum arabic 1.82 gm are hydrocolloids

(b) After frying chakli (50:50 black gram and check pea flour) and gaur gum 1.45 gm, gum arabic 1.82 gm are hydrocolloids

Fig 1: Scanning electron micrograph (SEM) of (a) before frying and (b) after frying of chakli.

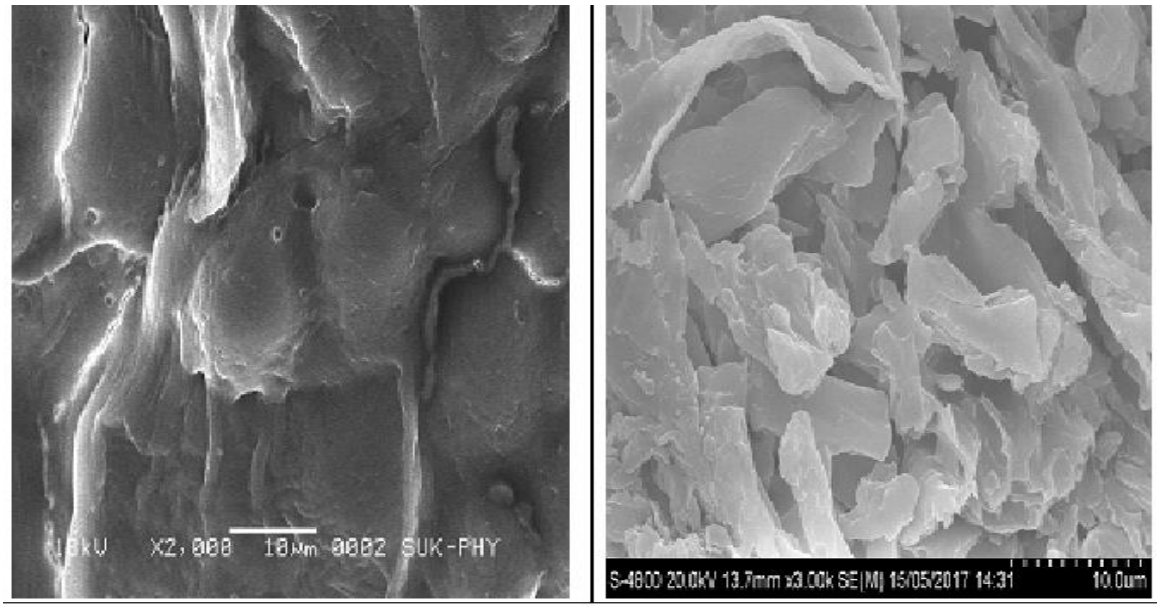
Composite flour of unpolished black gram and chickpea added before frying of chakli is (50:50) proportion and as per magnification image shows particles size varied from, large size particle of starch and small globules size protein particles gaur gum and gum arabic forms a thin layer like sheet above the starch and protein which works as binder in it.

So it has show that gaur gum and gum arabic binds the whole structure of chakli as a sheet and not separated from each other.

After frying chakli there is addition of black gram and chickpea as (50:50) proportion and as per magnification image shows after frying the gaur gum and gum arabic are cooked and show the smooth surface of gaur gum and gum arabic above the starch and protein body.

Where the gaur gum and gum arabic forms a thin layer (bridge) above the starch and protein and reduced the oil absorption in product.

Also as comparing the both before and after frying it has to detect the small layer of hydrocolloids which form above the starch and protein content.



(a) Before frying Sev (50:50 Polished black gram and chick pea flour) and gaur gum 0.29 gm, gum arabic 0.46 gm are hydrocolloids	(b) Before frying Sev (50:50) Polished black gram and chick pea flour) and gaur gum 0.29 gm, gum arabic 0.46 gm are hydrocolloids

Fig 2: Scanning electron micrograph (SEM) of (a) before frying and (b) after frying of sev.

Composite flour of unpolished black gram and chickpea added before frying of chakli is (50:50) proportion and as per magnification image shows same result like the chakli form a thin layer above the starch and protein particles. Gaur gum and gum arabic are the hydrocolloids which shows have the function of reducing the water binding capacity during soaking.

After frying Sev there is addition of polished black gram and chickpea as (50:50) proportion and as per magnification image shows same result like the sev form a thin layer above the starch and protein particles. Gaur gum and gum arabic are the hydrocolloids which shows have the function of reducing the oil binding capacity during frying.

Hydrocolloids have primary function for controlling the capacity of holding water as well as the viscosity of the product. The next functional aim is controlling the loss of water as well as uptake of oil in fried food items. Such an attribute comes under uncommon thermal gelatin ability in few of the hydrocolloids. This gel formation helps in offering a barrier resistant coating during heating.

4. Conclusion

The available technical data for the study of microstructure of the snacks product shows that proper smooth sheet and not separated from each other observed along with reducing water binding capacity during soaking i.e. before frying results and after frying shows the smooth surface of gaur gum and gum arabic above the starch and protein body. Where the gaur gum and gum arabic forms a thin layer (bridge) above the starch and protein and reduced the oil absorption in product during frying.

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