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Investigation of Psyllium Skin Gum Effects on The Rheological Properties of Milk Concentrate Protein (MPC)

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ABSTRACT: The aim of this study was to investigate the psyllium skin gum effects on milk protein concentration (MPC) with no thermal processing. Psyllium skin gumin diffent concentrations including (0 ,0.01, 0.03, 0.06, 0.09 % w/w) added to the MPC (1.5 % W/W), experimented by programmable rheometer Brookfield, model LV DV III, results evaluated by Rheocalc software , which displayed the most fitness to Hershel Bulkley model. Flow index (n) amounts , n>1, for samples revealed a non Newtonian behavior ,therefore by increasing shear rate in control and samples containing 0.01,0.03,0.09 % gum led to increase viscosity and displayed a shear thickening behavior, and an decrease in viscosity , followed by shear thinning behavior in sample containing 0.06 % gum , up to shear rate amount reach to 110 , the behavior observed the same with other concentration. The most viscosity was related to sample contains 0.09 gum.

***Keywords*:** Milk, Psyllium, Concentrate Protein

INTRODUCTION

Psyllium , with scientific name “plantagoovato Forsk”, refers to a kind of plant which is found in Iran , India and Pakistan is one them.The most important production obtained from this plant ,seed husk , and the rest utilizes to feed livestocks(Fischer, et al. 2004. Q. Guo, S. Cui, et al. 2009). Psyllium Mucilage , a completely non toxic compound , which has highly tendency to absorb water 20 times of its volume .Additionally , is a neutral compound that decrease cholesterol and adjust small intestine (Matsuhashi et al , 1992) . With respect to its highly gelling agent ,Psyllium Husk is utilized as a linked agent in replacing by chemical linking agent. (Q. Guo, S. Cui, et al. 2009).Psyllium compounds are environemnetllay friendly by impressive successfully effects on regions close to the seas in European countries and canada (Q. Guo, S. Cui, et al. 2009).Not completely just food properties related to protein polysaccharides system , but depends naturally on protein polysaccharide interaction overall (Hemar, et al. 2002).Proteins and polysaccharides are both additives which add to most of food formulations. Protein-polysaccharide combination enable colloidal phase to become stable and give food systems sensory properties (Perez, et al. 2009, Kruif and Tuinier 2001, Thompson et al , 2009).

Milk proteins , coming into account the most important of its technological part (Smit ,2003), include casein , caseinat, whey protein concentration , Milk Protein Concentration (MPC), Whey Protein Isolate (WPI) ,Ultrafiltration, Diafiltration prepared by non fat milk direct or indirect (Thompson, Boland, Singh 2009 and Aiqian 2011).MPC among them contains functional properties such as viscosity, emulsifire ,water holding capacity , enables it to utilize it in beverages , processed cheese and etc , produced by diafiltration and ultrafiltration and ion

exchange methods(Walstra, Wouters and Geurts 2006).Thanks to former information mentioned in literature , the aim of this study was designated to investigate psyllium husk Gum on rheological properties of MPC .

MATERIALS AND METHODS

20g of Psyllium skin ,which had bought from Rozdarou company , was weighed by Sartorius, Model TE2145, 0.0001g accuracy , mixed with water 30 times of its volume , then keep it in ambient Tem one night to remove its gum .After 1 night , the solution was put in the water bath Memmert model , 50°c for 30 min , gently shook every some min ,which enabled it to extract gum completely , then filtered in Bukhner Funnel and the yielded filtered gel mix three time its volume with ethanol (96 %) and continued to removed all of the sediments. Therefore by removing all of the color compounds and water, the obtained hydrocolloid dried in water bath Memmert model, 50°c for 24 hr , milled and kept in a closed laboratory dish.

Preparing of Protein gum solution

For stock solution 0.1 % , 0.1g of gum was weighed by Sartorius, Model TE2145, 0.0001g accuracy , gently shook in magnetic shaker , adding distilled water , continued to dissolve completely and then kept in refrigerator for 1 night to complete water holding by gum.

Preparing protein-gum mixture

2.14 g of MPC , based on its 70 % protein , weighed and transfer to the Volumetric flasks ,100cc .In order to provide solutions in volumes 0, 0.01,0.03 ,0.06and 0.09 , 0,10,30,60,90 cc of gum stock solution added respectively , then reached to 100 cc by pouring distilled water, gently shook by magnetic shaker in ambient Tem , kept in refrigerator 4°c , the next day after 10 min shaking by magnetic shaker got experimented on rheological experiments.

Rheological procedure

All rheological experiments were applied by using rheometer Brookfield Engineering Labs INC USA,model LVDVIII ,spindle ULE in 25°c ,provided by water bath 25°c and results analyzed by Rheocalc 3.2, Exell ver 2007and SPSS ver18 software. With respect to fitness of Hershel Bulkly model in describing the resulted data , this one selected to describe any of the rheological behavior of samples.

RESULTS AND DISCUSSION

As it shown in Table 1 , increasing gum concentration has been led to decrease consistency coefficient (K) , the most and the least amounts of it were related to 0.03 and 0.09 respectively. Comparison of consistency coefficient means in samples 0.03 and 0.09 revealed a significant differences , which displayed in none of the other samples. Flow index (n) was more than 1 (n>1) for all the samples which is concluded a non Newtonian behavior , the most and the lease amount of n were displayed in samples 0.03 % and 0.09 % concentration , yield stress(σ_0) was close to 0 or didn't observed .

Table 1. Comparison of the Mean of Flow Index (n), Consistency Coefficient

Sample	Treatment		Rheological model	σ_0(d/cm^2)	K(cP)	N	Co.F	R^2
MPC+ Psy	Psy	MPC	Herschel-Bulkley	0	0.002±0.00075	1.46±0.06807	99.6	0.998
	MPC+ NON	MPC+0.01Psy		0	0.0028±0.00153	1.41±0.07810	97.4	0.998
		MPC+0.03 Psy		0	0.0059±0.00294	1.29±0.07767	99.1	0.999
		MPC+0.06 Psy		0	0.0032±0.00331	1.44±0.17010	99.3	0.998
		MPC+0.09 Psy		0	0.0014±0.0032	1.52±0.03786	99.3	0.998

Figure 1,2 show that by increasing shear rate in control treatment (contains MPC) and samples 0.01 % ,0.03% and 0.09 %, increasing viscosity and shear thickening behavior observed , only in samples 0.06 % decreasing viscosity and shear thinning behavior , in amount of 110 for shear stress, that was the same with other concentrations .the most viscosity was related to samples containing 90.09 % MPC.

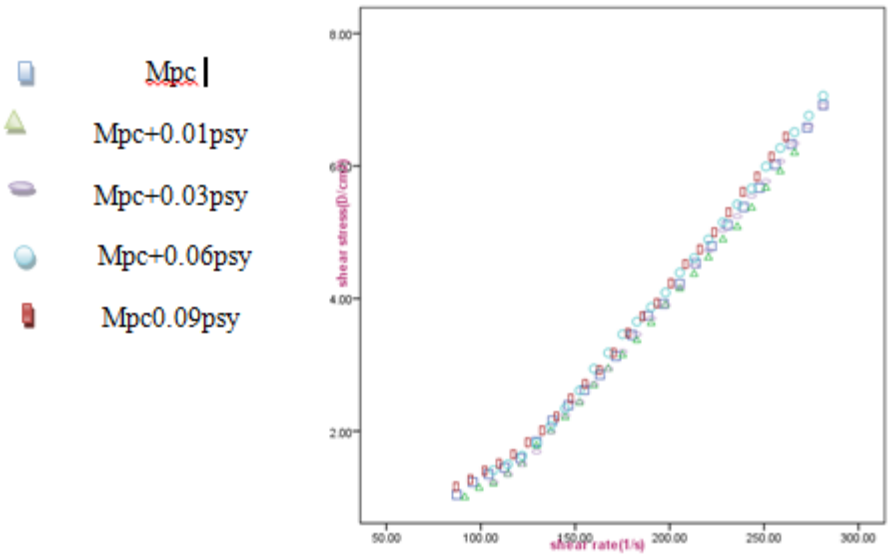

Figure 1. Shear Stress Vs Shear Rate in Control and Other Samples (containing MPC and Psyllium Skin Extracted Gum in Different Concentration)

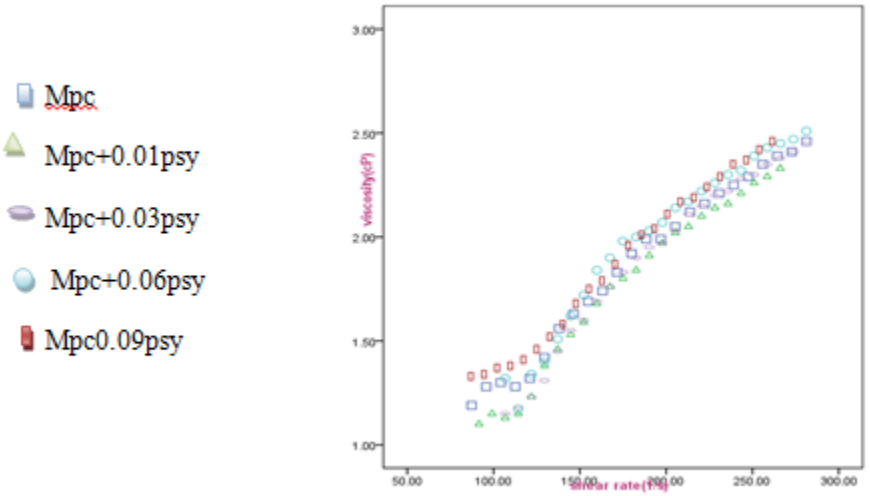

Figure 2. Viscosity Vs Shear Rate in Control and Other Samples (containing MPC and Psyllium Skin Extracted Gum in Different Concentration)

By increasing gum account , water absorbing increased due to gum tendency to water absorbing this one and the same tendency in MPC altogether resulted in increasing viscosity.

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