UNIVERSITI TEKNOLOGI MARA

EFFECT OF ORANGE SWEET POTATO (*Ipomoea batatas*) FLOUR SUBSTITUTION ON THE PASTING, RHEOLOGICAL AND TEXTURAL PROPERTIES OF FISH-FLOURS MIXTURE OF EXTRUDED FISH CRACKER

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ABSTRACT

Fish cracker or more commonly known as *keropok* in Malaysia is popular snack food among countries in the ASEAN region. The main starchy flour component used is tapioca starch (*Manihot esculenta*) that gives cracker expansion which was strongly correlated with consumer preference. Very few studies have been carried out on potential of other tuber sources to replace tapioca flour in formulation of fish crackers. Besides, the information on utilisation of freshwater fish in fish crackers was also limited. This study highlighted the potential usage of orange sweet potato (*Ipomoea batatas*) flour as an ingredient to substitute tapioca flour in fish cracker and as for types of fish, the red tilapia (*Oreochromis niloticus)* is used. Fish cracker manufacturing is mostly practised in small scale and extrusion cooking could simplify the process of stuffing and steaming. This stresses the importance of this work which studied the effect of orange sweet potato flour substitution to tapioca flour on the extruded fish cracker quality. The amount of orange sweet potato flour studied was at 20%, 30% and 50% of tapioca flour working range at fish contents of 20-70%. The physicochemical properties determined that orange sweet potato flour was lower in swelling power but higher in fat, protein and ash content and had higher gelatinisation temperature than tapioca flour. As a result, two endothermic gelatinisation temperatures were observed by differential scanning calorimetry (DSC) in fish-flours mixture with orange sweet potato flour substitution and the enthalpy gelatinisation was also low with orange sweet potato flour substitution. The DSC showed that the fish-flours mixture with 20% orange sweet potato substitution had lower gelatinisation temperature than fish-flours mixture with 50% orange sweet potato flour substitution. The rheology results indicated that the fish-flours gel with 20% orange sweet potato flour substitution had high G', low gradients and low tan δ at all measured temperatures. The texture profile analysis (TPA) indicates that the fish-flours gel was also hard, cohesive and springy. The fried extruded fish cracker with 20% orange sweet potato flour substitution was high in linear expansion, oil absorption and water absorption index, and was low in hardness and water solubility index. The product was slightly yellow and the field emission scanning electron microscope revealed that this formulation had big air cells with thin cell walls. The fried extruded fish cracker with 20% orange sweet potato flour substitution had high crispiness score and was highly accepted by the trained panellists. In conclusion, partial substitution of tapioca flour with 20% orange sweet potato flour in fish-flours mixture was easier to gelatinise and the gel had better elasticity and texture. Hence, high quality of fried extruded fish cracker was achieved with the 20% orange sweet potato flour substitution.

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TABLE OF CONTENTS

CHAPTER 1

INTRODUCTION

Fish crackers or known as *keropok* are popular snack food in Malaysia and Southeast Asian countries. In Malaysia, fish cracker is either consumed as *keropok lekor* (fresh *keropok)* or *keropok keping* (puffed *keropok*). The fresh *keropok* is more favourable than puffed *keropok* especially with strong fishy flavour (Taewee, 2011). Fish, the protein ingredients differentiate varieties of *keropok* in market and technically less tasty *keropok* created if fish is excluded (Taewee, 2011). Basically, fish cracker is processed by forming dough from a mixture of starch or flour, comminuted fish flesh and water. Salt, sugar and monosodium glutamate are also added in the mixture. The dough is then shaped as a cylinder, boiled to gelatinise the starch or flour and cut into slices prior to sun drying or hot-air dried (Siaw *et al.,* 1985). The dried crackers obtained is considered as half product or semi-finished product which are deep-fried in hot oil to obtain expanded, porous, low density and crispy product prior to consumption (Saeleaw & Schleining, 2011; Wang *et al.,* 2012).

Starch or flour is the principle ingredient in fish cracker. Starch serves the expansion properties of snack products (Wang, 1997). Tapioca or cassava starch (*Manihot esculenta)* which has greatest effect on product expansion and followed by sago starch (*Metroxylon* spp.) are usually used in fish crackers (Yu, 1991; Cheow *et al.,* 2004). Besides, fish crackers made from cassava starch had high crispiness score and were preferred by taste panellist compared to other types of flour (Siaw *et al.*, 1980; Yu, 1991; Haryadi, 1994). Crispiness was the main reason for rejection of crackers which in turn relate to the expansion characteristics. Mixtures of tapioca starch with different types of flour such as mung bean (Mohamed *et al.,* 1989), waxy rice and wheat flour (Saeleaw & Schleining, 2010) and green banana flour (Wang *et al.,*