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Sago's Role as Food Stock in 21th Century

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***Abstract*— Nowadays, Indonesia plays main role as the biggest sago fluor producer in the world. However the utilization of this food stock is relatively low. The sago fluor shows potential application in huge quantity as a food stock to contribute in a food security program. Currently, this sago fluor may be processed simply to become a noodle, vermicelli or sohun products. In the future development the sago fluor products should be improved in more varieties to become processed food to complement current staple food.**

***Keywords*— Sago fluor; Noodle; Food Security.**

I. Introduction

The food crops available in Indonesia include rice, sago, maize, greenpeal, soybean, peanut, sweet potato, cassava, except wheat crop. In Indonesia, potato crop is cultivated in limited areas, and all of the wheat flour was imported. The plaintain and banana trees are usually cultivated on rural people's small gardening. The sago palm is harvested from cultivated and wild stands in Indonesia.

In the last decade in 2001, the production of milled rice was at amount of 31,132,083 tons. This rice production of Indonesia was equal to 5.2 % of global rice production at that time. Regarding to Indonesia population growth during period until 2022 it will require more 3,905,000 tons of milled rice as staple food.

By considering similar trend of other food stock consumption such as wheat flour based food at rough quantity of 6,600,000 tons annually, there are two exit main ways or its combination to secure the food consumption either to open new rice field including required fertilizer, or to promote other food stock to complete staple food.

This paper describes the second exit way to contribute in a food security program by promoting sago fluor as food stock through developing sago based processed foods. Unfortunately this sago fluor is mainly obtained from natural stands, and hopefully it promotes people to develop sago palm cultivation.

II. Sago Fluor

Sago flour is obtained from sago palm trees. This plants grow well in Papua and other provinces in Indonesia. This sago plays role as a staple food for people in Moluccas and Papua. Currently sago palm is also obtained in Sumatra, Kalimantan, Sulawesi, Moluccas, and Papua. In Java sago grows can be found in limited areas in the western and northern side of Java.

The most potential area of sago flour in Indonesia is located on Papua. This sago palm mostly grows naturally for centuries. The sago flour production capacity can be obtained only from Papua at amounts to 24,418,095 tons per year. Unfortunately its actual production rate of sago flour actually is only about 186,000 tons per year.[1]

Nowadays, the sago consumption rate in Indonesia reaches more or less 585,093 tons per annum. This value is only 2.14% of projected sago flour production capacity totally of 27,364,170 tons per year. The socialization and development of sago based food will promote this sago flour to become the potentially starch food for the 21st century. Based on currently compiled data, Indonesia sago palm is currently dominating sago palm distribution in the world as listed in Table 1 herein. However, it should be known that Brazilia is also developing the large sago palm cultivation in Amazon area to contribute more in the future regarding to sago based food security and biotechnology.

In the past time, Papua, Moluccas and Mentawai people consume sago fluor as a staple food. However, in this time these people also consume the rice as the new staple food. This situation may be influenced by transmigration and people mobilization through government program or independently from other provinces into these areas during last decades Sago is likely rice and other known staple food. It contains high nutrient content of carbohydrate, protein, fat, calcium, and iron. Sago starch contains 27% amylose and 73% amylopectin. The physical characteristic of sago starch depends on this content. Higher amylose in starch indicates slightly wet, less tacky and hygroscopic. Sago granules shows an ellipse cut shape with size 20-60 m and gelatinization temperature around 72 + 10 ^{o}C

TABLE I
SAGO PALM STANDS

No	Country / Provinces	Sago palm plantation, hectares	Projected sago flour, Tons / year
I	Indonesia		
1	Sumatra		1,549,680
	Aceh	10,396	155,940
	Riau	69,916	1,048,740
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	Mentawai	3,000	45,000
	Selat Panjang	20,000	300,000
2	Java		4,500
	West Java	300	4,500
3	Kalimantan		45,000
	South Kalimantan	5,304	79,560
	West and SW Kalimantan	3,000	45,000
4	Sulawesi		683,100
	North Sulawesi	23,400	351,000
	South Sulawesi	8,159	122,385
	Central and South West Sulawesi	13,981	209,715
5	Moluccas		629,235
	Seram	19,494	292,410
	Halmahera	9,610	144,150
	Bacan	2,235	33,525
	Buru	848	12,720
	Aru islands	9,762	146,430
6	Papua		24,418,095
	Sorong *	499,642	7,494,630
	Merauke *	342,273	5,134,095
	Mamberamo*	21,537	323,055
	Bintuni *	86,237	1,293,555
	Fakfak *	389,840	5,847,600
	Biak *	21,537	323,055
	Jayapura *	36,670	550,050
	Salawati*	6,137	92,055
	Papua	40,000	360,000
	Waropen	200,000	3,000,000
	Indonesia, total	1,843,278	27,364,170
II	Papua New Guinea*	1,000,000	
	Papua New Guinea	20,000	
III	Malaysia, Sabah	10,000	
	Serawak	53,000	
	West Malaysia	5,000	
IV	Thailand	3,000	
V	Philippines	3,000	
VI	Other countries	5,000	
	TOTAL	2,942,278	

*: wild stands
Source: H.Subawi and M.Ahmad (2013).

So far, tropical agronomists considered sago to be an underused and neglected crop. They observed that the sago forests are self-regenerating, and the industry is based on the exploitation of existing forests for production and vegetative propagation. Dur to this reason, Indonesia government is preparing to develop the sago fluor processing industry in Papua with investment value more than US $ 5 millions (Inhutani, 2012).

NOODLES

Historically, the noodle was firstly invented by Momofuku Ando in 1958, the founding father of Nissin corporation and produced the first instant noodles in the world. The Japanese noodle with chicken taste and calle d as Chicken Ramen.

Nowadays, the varieties of noodles are available in Indonesia. These noodle products are named based on the raw materials utilized in noodle processing. These include (a) instant noodle made of wheat flour, cassava or sago, (b) vermicelli made of rice flour, maize flour, (c) Kuey tiau or flat noodle made of combined rice and wheat flours, and (d) sohun / soo-hun / soon / glass noodle / sago noodle / sago fensi made of arrowroot or sago.

The consumption rate of sohun may reach 100,000 ton per annum in Java. In Indonesia, the noodles industries are concentrated in Java island. Noodle is defined as wheat based noodle either wet or instant noodle. Processed sago starch are consumed mainly in the form of sago noodle or sohun.

A. Wheat Noodle

In Indonesia, instant noodles are mostly produced from imported wheat flour and positioned this country as the second biggest producer of wheat noodle in the world. The key nutrient in wheat flour for noodle processing is protein to make gluten. The protein content plays main roles during noodle process. The elasticity and tough properties depends on gluten quality and its content.[2]

The requirement of nutrient and product safety of processed food in Indonesia refers to international regulation. Ministry of Health of Indonesia (2010) has rectified regarding to methyl p-hydroxybenzoate trace in ketchup during instant noodle processing that is still within tolerant.

The wheat noodle is one of favourite complementary food in Indonesia. Beside instant noodle, the other varieties of noodles may include fresh noodle, wet noodle, dry noodle, and egg noodle. These noodles are processed through process sequences of preparation, mixing, sheeting and cutting. The noodles differentiation depends on ingredient composition, cooking method and drying requirement.

In Indonesia standard of SNI No. 3551-1994, the instant noodle is defined as dry food product made of wheat flour with or without additional other ingredient and permissible food additive, in specific shape likely noodle and ready to be served through cooking or pouring boiled water within 4 minutes. In commercial product of instant noodle is frequently added by kalium carbonate, carboxy methyl cellulose and sometime guar gum. carboxy methyl cellulose roles as gluten with expansion characteristic to the wheat starch, whereas the yellow colour is due to an additional brine solution. Typical brine solution consists of 15% natrium chloride, 0.26% natrium carbonate and 0.26% kalium carbonate. The instant noodle is able to absorb vegetable oil during frying, so that this instant noodle taste is more delicious than others.

B. Cassava and Sago Noodles

Traditionally, noodles are also made of tapioca in limited quantity. This cassava noodle has being produced traditionally and consumed locally. In Yogyakarta Central Java there are home indutries develop the traditional noodle that is called turbid noodle. Turbid noodle is processed by utilizing tapioca starch and dried cassava as raw materials. [3]

In the past time, these raw materials are mixed by means of cattle moved cylindrical mixer. The mixed materials are steamed and mixed further to control water content. The dough is pressed and steamed further. The final step is molding and dried in the sun until dry.

In sago noodle processing, it is made of sago flour, water and peanut oil. Sago flour should be clear and white with >90% white scale. The Metroxylon sagu may be the preferable sago flour for sago noodle production. The peanut oil (Arachis hypogeae) may be added to improve the noodle taste, to reduce tacky properties and to improve its appearance. This oil can be substitued by other vegetable oil.

It is noted, some countries makes confusing term in starch, include Thailand, frequently uses the same term of sago starch and cassava starch. The sago term in this paper only describes the true sago starch, instead of cassava.

C. Rice Bihun

Bihun also called as vermicelli, is kind of derivative food originally made of rice flour. At domestic market there are two kinds of bihun i.e. dry bihun and instant bihun. Dry bihun is a food stock likely yarn that made of rice flour with or without additives. Whereas instant bihun is likely dry bihun and ripe after cooked or poured boiling water less than 3 minutes.

In Indonesia, vermicelli production mostly using imported rice flour and increased significatly since 2009. Due to stable price of imported rice flour, it may cause ans increase production of bihun using imported rice flour without using existing domestic rice production.

Practically the best rice varieties for bihun production are PB 5, PB 36, PB 42, IR 26, IR 36, Semeru, Asahan, Birma, Siram and Hongkong rices. The desired flour for bihun should be untacky while cooked, in which it will ease rolling and forming processes. While sticky rice yields soft and sticky bihun.

D. Maize Bihun

As the price fluctuation of maize at about half of rice price, the maize bihun production tended to increase during last decade. The maize as raw material of bihun may compete with the sago flour for the similar production purpose in the future. While it is compared to rice flour, the maize bihun processing is considered more economical. Of course it also depends on the people taste and flavour interest.

The development of maize noodle product involves increasing elasticity properties either through gelatinization or additional protein content or its combination. Generally the maize flour contains less protein in its starch than wheat flour, so that gelatinization properties should be improved.

The maize noodle is mainly prepared through pre-gelatinized step of dough prior to make dough lump. The dough gelatinization purposes to prepare dough lump and casting process. The gelatinization step is related to maize flour characteristic that does not contain proper gluten to form elastic and tough properties such as wheat flour. [4]

E. Sago Sohun

In Ngawen Klaten, Central Java it was reported the home industries producing sohun noodle with capacity at about 17 tons per day. This capacity may be equal to 6,000 ton / annum. The sohun noodle is made of either aren sago flour (Arenga pinnata / saccharifera) obtained locally, or sago flour (Metroxylon sagu) from Sumatra. The noodles are dried in the sun within 3 hours on the zinc plate to absorb sun light maximally.

The producers identified that pure arenga sago flour yields more elastic noodle and glossier than Metroxylon sago flour. The additional arrowroot flour to the arenga flour improves the flavour interest and noodle taste. Due to lack of arenga flour nowadays, it caused tendency of raw material replacement referred to Metroxylon sago flour for the sohun noodle production. The sohun noodle is relatively smaller than the common noodles.

III. CONCLUSIONS

The sago fluor shows potential application in huge quantity as a food stock to contribute in a food security program. This sago fluor may be processed simply to become a noodle, vermicelli or sohun products. In the future development the sago fluor products could be improve more varieties of processed food to complement current staple food.

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