# ARTICLE REVIEW; PCALAMARI INK UTILIZATION FOR NATURAL DYES AND BIOPHARMACEUTICALS

**Junianto[1], Fazira Parliamentary[2], Habby Shafarudin[2], Naomi Golda Youwe[2], Syifa Nurhidayah[2] and Tarisa Rusmana[2]**

*1) Lecturer staff of the department of Perikanan_ Padjadjaran University*
*2) Students of Fisheries Study Program – Padjadjaran University*

ABSTRACT

Squid is one of Indonesia's leading export products. Squid - squid is generally used as a food ingredient. Squid - exported squid is in frozen and dried form. The impact of these processing activities can produce waste, one of which is squid ink. This article aims to review the compounds contained in squid ink and their use for non-food products, biopharmaceuticals and natural dyes. Based on the results of the review, it can be informed that squid contains melanin, protein, fat and glycosaminoglycans which when used can be anti-cancer, anti-tumor and anti-bacterial in health sector. In addition, squid ink can be used as a non-food or medical product, for example ikat woven fabric products typical of East Nusa Tenggara.

Keywords : Fish weaving, protein, melanin, health, waste.

## INTRODUCTION

Indonesia is the largest maritime country in the world with abundant marine products, the value of fishery exports from year to year is increasing (BPS 2022). When viewed based on commodities based on data International Trade Center (ITC) Trademap, the export value of Squid - Cuttlefish - Octopus ranks third after shrimp and Tuna - Skipjack. The export value of Cumi -Sotong - Gurita amounted to USD 509 million or 6.0% of the total exports of Indonesian fishery products (Kementerian Kelautan and Perikanan – Indonesia, 2021).

Squid is one of Indonesia's leading export products. Squid - squid is generally used as a food ingredient. Cumi - exported squid is in frozen and dried form. The impact of these processing activities can produce waste, one of which is squid ink.

So far, many people think squid ink is not useful so that if you process squid, the shells and ink bags are thrown away. The part of the squid's body that is often used and utilized is the meat part. However, in squid processing, the squid ink part is not processed. In Japan, squid ink is used as a flavoring ingredient, besides squid also has health properties (Sasaki et al.,1997).

Squid ink waste if not used has the potential to pollute the environment because it contains a lot of organic matter (Dislautkan Kab. Starch 2013). Based on the results of several studies, it is informed that squid ink waste contains a variety of organic materials that will affect the characteristics of groundwater. Squid ink will also cause unpleasant odors and cause pollution to the environment. This article aims to review the compounds contained in squid ink and its utilization for non-food products, biopharmaceuticals and natural dyes.

### Scompounds contained in Squid Ink

The characteristic of squid is the presence of an ink sac that is located above the large intestine and empties near the anus. Squid ink liquid generally contains melanin pigment which is naturally present in the form of melanoprotein with a melanin content of 90%, protein 5.8%, fat, and carbohydrates 0.8% (Agusandi *et* al. 2013).

Squid ink also contains a lot of vitamin A, glycosaminoglycans and amino acids. In squid ink, there are 14 types of amino acids consisting of non-essential amino acids, namely glutamic acid, alanine, aspartic acid, glycine, serine, and tyrosine. While the content of essential amino acids includes lysine, isoleucine, valine, arginine, threonine, histidine methionine. phenylalanine, and leucine. The highest non-essential amino acids in squid ink protein hydrolysate are glutamic acid and alanine with values of 0.35 % and 0.30%, while the highest essential amino acids are phenylalanine and leucine with values of 0.23% and 0.21% (Kurniawan 2013).

Some of the compounds contained in squid ink melanin are 5,6-dihydroxyindole-2-Carboxylic Acid (DHICA), 5,6-dihydroxyindole (DHI) and 2-Carboxyl indole (Nasution et al. 2017). Inaddition, the three components with the highest amount were found, namely cinnamic acid, betaine, and choline (Idris Affandi et al. 2019).

**Utilization of waste Squid Ink For BioPharmaceuticals**

The need for alternative medicines of natural origin that effectively address polymicrobial infections is increasingly urgent for the improvement of the quality of human life. Natural bioactive substances have fewer side effects than synthetic substances thus making them safer for the host's body.

The sea provides products that are very useful for the future of medicine. One of the seafood that has pharmaceutical properties is squid, especially the ink it produces. Squid ink is proven to play a major role in the world of alternative medicine and has a wide range of therapeutic applications as an antiretroviral, antitumor, antioxidant, and its capabilities in protecting cells from damage resulting from chemotherapy. The antibacterial potential of squid ink against pathogenic bacteria has also been widely publicized. Recent studies have shown squid ink extract to have antibacterial effects against betalactam-resistant bacteria *E. coli* and *K. pneumoniae* (Bara et al. 2013).

According to Amiruddin (2013), squid ink also contains a lot of vitamin A which can activate white blood cells to combat tumors. Squid ink contains a high level of peptidoglycan, which acts as an anticancer and antitumor agent through an increase in the number of leukocyte cells.

Melanin from squid ink has anti-tumor activity by inhibiting plasmin activity to increase platelets and boost the immune system to kill cancer cells (Zhong et al. 2009). The anticancer compound is a mucopolysaccharide as a carbohydrate from peptidoglycan (Delianis et al. 2013). Anticancer research on squid ink is still relatively small due to lack of information about the importance of squid ink as an anticancer.

The content of melanin extract in squid ink has the ability to bind Fe2 + which is the most effective metal ion in accelerating the oxidation process of lipids. Melanin is able to bind to Fe2+ due to the structure of the 2-carboxyl indole contained in melanin's.

Squid ink also contains DHI and DHICA which have a strong character to absorb the -OH and –NH structures so that it can make sure that squid ink has antioxidant capabilities. Inhibitory Concentration (IC50) in O2- (superoxidd) clearance is more efficient compared to commercial antioxidant drugs (Carnosin). In the presence of antioxidants, the mechanism of oxidative modification of LDL cholesterol into LDL-ox it will not happen because antioxidants will bind free radicals. Another effect of squid ink melanin is a positive effect on the lipid profile of the blood. Squid ink can lower levels of total cholesterol, triglycerides, LDL cholesterol, and increase HDL cholesterol levels. (Nasution et al. 2017)

Squid ink can act as a cell protection drug in cancer treatment by means of chemotherapy, through an increase in the number of leukocyte cells and bone sum-sum nucleic cells. Currently, chemotherapy is still the basic terapi for the treatment of tumors. Cyclophosphamine is an important clinical drug. The drug can kill tumor cells and help the patient to heal, but on the other hand, it is known that the drug can also kill healthy cells from many tissues and organs.

**Utilization of waste Squid Ink For Natural Dyes**

Squid ink as a natural dye is used to embellish ikat woven fabrics. In the manufacture of ikat woven fabric, dyes are needed that will provide shades and motifs of the resulting fabric. The use of this natural dye is to minimize the use of centetic dyes that have a negative impact on the environment (Nitsae *et* al. 2017)

Especially on Alor Island, East Nusa Tenggara is used as a dye for ikat woven fabric that can give a black color. The squid ink used is not changed in any other form. The ink taken is directly applied to the threads used in the process of forming ikat woven fabrics. Squid ink is also modified in powder form aimed at the storage of ink as a dye of woven fabrics for a long period of time (Merpiseldin et al. 2017).

Squid ink coloring agents in liquid form are easy to undergo organoleptic changes, namely a pungent aroma that indicates squid ink is reactive with temperature conditions room, so it is difficult to store for a long period of time. Therefore, to overcome this, it is necessary to dry to obtain effective dye powder granules that can be stored longer but still have ability as a natural dye for ikat woven fabrics. Other uses also need to be carried out because of the nature of squid ink powder which is not easily soluble in water.

The procedure for using squid ink as a natural dye is as follows: First take the squid ink from the squid bag, that is, the squid ink is removed from the bag and put in the prepared container. The next stage is the preparation of the woven fabric to be dyed. The process is that the woven fabric is soaked or dipped in a 10% alum solution at a temperature of 45$^{o}$C for 1 hour, while stirring. Soaking continued for 12 hours but at room temperature (25 o C –

$27^oC$). Then the cloth is lifted and rinsed with hot water and cold water alternately then dried. The dried cloth is dipped in squid ink. To preserve the squid ink used as a dye material for ikat woven fabric is carried out by the addition of a fixator to the squid ink. A frequently used type of fixator is K2SO4. Al2(SO4)3 (alum), Ca(OH)2 (quicklime), and FeSO4 (tunjung). Fixation is a process to strengthen the color so that it does not fade easily. Thus, the purpose of using a fixator is to neutralize and evoke coloring agents that have entered into textile fibers (Kartikasari and Susiati 2016).

**CONCLUSION**

Squid ink contains melanin, protein, fat and glycosaminoglycans which when used can be anti-cancer, anti-tumor and anti-bacterial in the health sector. In addition, squid ink can be used as a non-food or medical product, for example ikat woven fabric products typical of Nusa Tenggara Timur.

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