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POTENTIAL OF DRAGON FRUIT PEEL AS COLOUR PIGMENT IN FISH FEED

Shela Rihadatul Nabila*, Yuli Andriani, Rosidah, Fittrie Mellyanawatie Pratiwy
Faculty of Fisheries and Marine Science, Padjadjaran University, West Java, Indonesia

Corresponding Author: shela18002@mail.unpad.ac.id

ABSTRACT

Dragon fruit is the fruit of a cactus-like plant called *Hylocereus*. This plant is known as pitahaya, and in English, it is called Dragon fruit. There are three types of dragon fruit in Indo- nesia: *Hylocereis undatus* (dragon fruit with white flesh), *Hylocereus* polyrhizus (dragon fruit with red flesh), and *Hylocereus costaricensis* (dragon fruit with very red or black flesh). The biggest cost in the livestock business is feed, which reaches 60–70%. One alternative to supply is to utilise waste, both agricultural, livestock, and industrial waste. contains active compounds, namely vitamins A, C, and E, alkaloids, terpenoids, flavonoids, thiamine, niacin, pyridoxine, cobalamin, phenolics, carotene, and phytoalbumin. Dragon fruit skin has a red pigment that can potentially be used for food colouring, so it can give food an attractive colour. The method used is to study literature. The results obtained show that dragon fruit skin can be used as a colour pigment to maintain the colour quality of fish. In addition to materials that are easy to obtain by utilising agricultural waste, the ingredients contained in dragon fruit skin are by the needs of fish.

KEYWORDS

Dragon fruit, dragon fruit skin, colour pigment.

INTRODUCTION

Dragon fruit is a fruit plant that belongs to the cactus family and grows wild in the forests of Central America and South America. Dragon fruit is known as pitahaya; in English, dragon fruit is called dragon fruit, which is the fruit of a cactus-like plant called *Hylocereus* (Winahyu et al., 2021). Dragon fruit has a potential market demand that continues to increase. There are three types of dragon fruit in Indonesia, namely *Hylocereus undatus* (dragon fruit with white flesh), *Hylocereus polyrhizus* (dragon fruit with red flesh), and *Hylocereus costari- censis* (dragon fruit with very red or black flesh) (Simangungsong, 2014).

In feed, cultivation is important and needs attention. Meanwhile, according to Satria and Marhayani (2020), the biggest cost in the livestock business is feed, which reaches 60– 70%. The feed given must certainly pay attention to its quality and quantity to obtain optimal production results. One alternative for supply is to utilise waste, both agricultural, livestock, and agricultural industrial waste (Dewi et al. 2018).

To improve the colour quality of fish, it is necessary to engineer feed nutrition, one of which is by maintaining and improving the quality of fish colour through the addition of carot- enoids to feed (Sinaga and Butarbutar 2021). Pigmentation and colour in fish are affected by the absorption and accumulation of carotenoids in the body (Gouveia et al. 2003). Aquatic animals cannot synthesise carotenoids in their bodies; therefore, they must obtain pigments from feed (Amin et al. 2012). The addition of colour supplements in the form of beta-carotene to fish feed will improve the quality of fish colour more quickly (Lesmana and Satyani 2002).

Colour pigments used in fish feed can be produced in fruits, vegetables, and animals that contain carotenoid sources (Kalidupa et al. 2018). Pigments are non-nutritive compounds that promote colour (Andriani 2022). According to Meilisza (2023), the pigments used for col- our are carotenoids, three types of pigments will form colours, namely melamine (black), erythrin (red), and xhantin (yellow), while other colours are obtained from a combination of the three types of pigments

MATERIALS AND METHODS

The method used is a literature study related to the potential of dragon fruit as a pigment in the fish feed that is relevant to the keyword colour pigment, dragon fruit and fish feed from various sources such as Gooogle Scholar, Elsevier and Research Gate.

In Indonesia, red dragon fruit (*Hylocereus polyrhizus*) has been widely consumed by Indonesians. The fruit flesh is sweet, smooth, white, or red-purple, and there are many small black seeds (Wahdaningsih et al. 2015). (Figure 1.) The classification of dragon fruit, according to Wahyuni (2017), is as follows:

Kingdom : Plantae

Phylum : Spermatophyta

Class : Dicotylrdonae

Order : Cactales

Family : Cactaceae

Genus : Hylocereus

Spesies : *Hylocereus polyrhizus*

Figure 1. Dragon fruit

Dragon Fruit Skin Content

It is known that dragon fruit skin contains nutrients that can be utilised. The nutritional content found in red dragon fruit skin, such as carbohydrates, fat, protein, and dietary fibre, contains natural pigments that can be used as natural food colouring (Waladi et al. 2015).

Dragon fruit skin also contains active compounds, namely vitamins A, C, and E, alkaloids, terpenoids, flavonoids, thiamine, niacin, pyridoxine, cobalamin, phenolics, carotene, and phytoal- pha-bumin (Fitria 2021). According to Kalidupa et al. (2018), dragon fruit skin contains 10.79% water content, 17.93% ash content, 11.44% protein, 1.11% fat, and 28.10% crude fibre.

Dragon fruit skin contains a red pigment that has the potential to be used for food colouring, so it can give food an attractive colour (Hidayah et al. 2014). Anthocyanin pigments that produce a red colour on dragon fruit skin include cyaniding -3-sophoroside and cyaniding -3-glucoside (Tasyur and Suyani 2016). Red dragon fruit skin contains a rich source of polyphenols and antiox- idants (Noor et al. 2016); these contents act as an immune system against disease attacks on living things (Efianda et al. 2020).

Figure 2. Dragon fruit peel

Colour Pigmentation Process

The colour found in comet fish is due to the presence of pigment cells in the epidermal layer. Colour changes that occurs is caused by a change in the amount of pigment, and the addition of feed ingredients that carry pigments in the feed will increase the brightness of the colour in fish (Nurrahma et al. 2018). Pigmentation and colour in fish are affected by the ab- sorption and accumulation of carotenoids in the body (Gouveia et al. 2003).

According to Julia (2019), the process of chemically forming colour in fish is done by fat-soluble carotenoids, which will be digested by lipase enzymes and bile salts in the intestine. Bile salts work as substances that help maintain fat stability so that small fat particles called micelles are formed. Carotenoids present in the cytoplasm of the small intestine mucosal cells will be broken down into retinol, then absorbed by the intestinal wall along with fatty acids in a passive diffusion way, combined with micelles, united to form bubbles, and then absorbed through the lymphatics. Furthermore, micelles, together with retinol, will unite with palmitic acid and be stored in the form of retinyl-palmitate. Retinyl-palmitate will be bound by Retinol Binding Protein (PPR), which is synthesised in the liver and then transferred to other proteins to be carried to tissue cells. The colour of the fish is dense due to the distribution of pigment cells evenly, otherwise the colour of the fish body is pale due to pigment cells gathered at one point of the cell nucleus (Meilisza et al., 2021) (Figure 3)

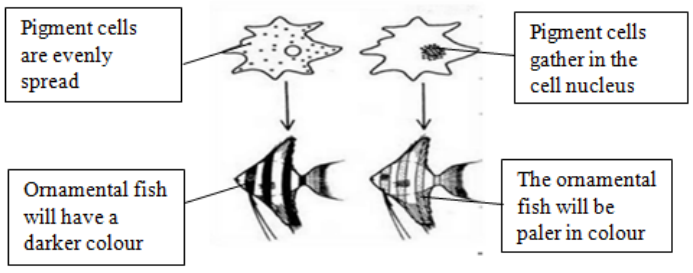

Figure 3. Distribution of colour cells in fish

Dragon Fruit Peel as Colour Pigment in Feed

As much as 30–35% of the dragon fruit is the skin of the fruit, but it is often thrown away as waste (Saati 2010). According to Slamet et al. (2022), in 2020, the total amount of dragon fruit peel waste produced will reach approximately 40,000 tonnes. Even though dragon fruit skin has the nutritional content that can still be utilized.

According to Efianda et al. (2020), dragon fruit peel contains fibre, carotene, calcium, phosphorus, and vitamins B and C and can act as an antibacterial and antioxidant. Dragon fruit peel can be used as a colour pigment in various forms, such as powder, extract, infusion, etc. The addition of colour pigments to the feed will encourage an increase in the colour of the fish's body and be able to maintain the dyes in the body (Subamia et al. 2010). Dragon fruit skin contains high levels of beta-carotene, so red dragon fruit skin can be used as an additional ingredient in feed to improve the quality of colour in fish (Nurrahma et al. 2018). In the fol- lowing, various studies that have been conducted to optimise the potential of dragon fruit peels that can be used as colour pigments in fish feed (Table 1).

Table 1. Dragon fruit peel as a colour pigment in fish

No	Types of Dragon Fruit	Treatment	Results	References
1.	*Hylocereus polyrhizus*	Addition of 5, 10 and 15% dragon fruit peel flour in the test diet	The highest addition of dragon fruit peel flour at 10% can affect the col- our quality of comet fish with a value of 28.16.	(Udjan *et al.* 2023)
2.	*Hylocereus polyrhizus*	Addition of 5, 10 and 15% dragon fruit peel flour in the test diet	The highest addition of dragon fruit peel flour at 15% can increase the or- ange colour and black colour of koi fish but does not have a signifi- cant effect on growth.	(Kalidupa *et al.* 2018)
3.	*Hylocereus polyrhizus*	Addition of 0.5 and 1 gram of dragon fruit peel flour in the test diet	The highest addition of dragon fruit peel flour at 1 gram can increase the brightness of the colour and growth of goldfish.	(Rani *et al.* 2022)

4.	*Hylocereus polyrhizus*	Addition of dragon fruit peel flour at 10, 20, and 30% in the test diet	The highest addition of dragon fruit peel flour at 10% can increase the brightness of clown fish colour with a value of 7.73.	(Barros *et al*. 2023)
5.	Hylocereus costaricensis	Addition of dragon fruit peel flour at 3, 6 and 9% in the test diet	The highest addition of dragon fruit ku-lit flour at 6% with a value of 134.9 ± 14.9 on day 10 can increase the brightness of the colour of areca nutmeg fish and the average survival value is 100%.	(Etrianda 2020)
6.	Hylocereus polyrhizus	Addition of 1, 1.5, 2 and 2.5% dragon fruit peel extract in the test diet	Giving the highest concentration of dragon fruit peel extract as much as 2% can provide a level of brightness in the colour of hippopotamus fish	(Halim Abdul 2022)
7.	Hylocereus costaricensis	Addition of 1, 3 and 4 grams of dragon fruit peel flour in the test diet	The highest addition of dragon fruit peel flour as much as 1 gram can provide a level of brightness in the colour of comet fish.	(Puspaningtyas 2022)
8.	Hylocereus polyrhizus	Addition of 5, 10 and 15% dragon fruit peel extract in the test diet	The highest addition of dragon fruit ku-lit extract as much as 15% can provide a level of colour brightness in Nemo fish with an average value of 3.93.	(Bianco et al. 2022)

9.	Hylocereus polyrhizus	Addition of 0.25, 0.5, 1 and 1.5% dragon fruit peel extract in the test diet	The highest addition of dragon fruit extract at 1.50% can increase the brightness of the chef carp colour with a value of 30.02.	(Wijaya et al. 2021)
10.	Hylocereus polyrhizus	Addition of dragon fruit peel infuse at 2.5, 5, 7.5 and 10% in the test diet	The addition of the highest dragon fruit peel infusion of 10% with an average value of 4.6 can affect the colour quality of koi Kohaku fish.	(Nurhadizah dan Puspitasari 2021)

CONCLUSION

Based on the results obtained from various sources of literature regarding the potential of dragon fruit skin as a colour pigment in fish feed, it can be concluded that in the process of cultivating ornamental fish, dragon fruit skin can be an alternative and a recommendation for farmers to maintain the colour quality of fish. Dragon fruit skin can be changed into flour, extract, infusion, and so on, which has the function of increasing the brightness of the colour of ornamental fish. In addition to the ingredients that are easy to obtain by utilising agricultural waste in the vicinity and the content contained in dragon fruit skin, it is suitable for cultivation needs and is safe for fish health.

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