MULBERRY USAGE AND ITS INDIRECT POTENTIAL IN COSMETIC INDUSTRY IN MALAYSIA

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ABSTRACT

Mulberry is a shrub or tree used in various countries and recognized as the main feed for silkworm for sericulture industry. It is also known as an exquisite vegetable (young leaves and stems) as its fruit (fresh, juicy, alcoholic, preserving), medicinal properties (mulberry leaf tea), landscaping and animal feed, etc. Based on its multi-function characteristics, mulberry can play a significant role in agriculture. It is a highly versatile plant in smallholder farming that can be used in various ways. Its value is multifaceted, and its use is enormously extended and diversified. The main objective of this paper is to review the current worldwide use of mulberry and to explore its indirect potential in the Malaysia's cosmetics industry to encourage more farmers to grow mulberry trees.

Key words: cosmetic, mulberry, sustainable, sericulture, silkworm

INTRODUCTION

Mulberry is distributed worldwide since it is strong enough to thrive under disruptive conditions. Mulberry plants belong to the Moraceae family and are successfully grown in a range of climates, ranging from warm temperate and subtropical regions of Asia, Africa, Europe and others with the majority of species native to East and South Asia. There is ample of mulberry species but Mulberry *Morus alba L.* is very common in East and North East India.

According to Buhroo et al. (2018), due to its's multifaceted value and its use can be enormously extended and diversified as there are several countries in which mulberry is historically used as feed in ruminant and silkworms which in turn produce silk fiber. As stated by Hussain, Rana, Shafique, Malik, & Hussain (2017), medicinal plants from Moraceae family have been well-recognized worldwide due to their versatile applications in various fields including agriculture, pharmaceutical and food as well as in cosmetic industries.

However, the major activities involved in a sericulture industry are focus on silk textile industry as stated by Anitha & Kanimozhi (2013). This has led to a reduction in the number of silk farmers and land area for mulberry cultivation since the others potential of silkworm has not been explore widely. Therefore, the venture of mulberry plantation in the silkworm industry will causing the potential for the mulberry will be expanded in silkworm industry that will produce sericin as by-product that will be used in cosmetic as a natural ingredient since today the trend for a healthier way of living is increasing consumers' perceptions and interest towards mainly natural products, including cosmetic products as stated in Matic' & Puh (2016) studies.

THE USAGE OF MULBERRY PLANT

Mulberries have been grown in many countries solely for the purpose of feeding *Bombyx mori* L, a monophageous silkworm. However, mulberry was recently re-evaluated for other uses, such as medicinal products, the processing of fruits and animals (Chandrashekhar & Hj, 2020).

MULBERRY AS FOODSTUFF

Buhroo et al. (2018) stated that mulberry is basically a source of delicious fruit and popular among many countries of the world. Mulberry is very popular for sweet food products such as jams and jellies because it contains a high sugar content. It is possible to eat mulberry fruit raw, cooked or used in preserves. Mulberry makes the perfect dessert fruit due to its sweet taste with mildly acidic. The fruit should be used immediately once it ripe. Another form of mulberry fruit use is by transforming into powder after the fruit has been dried. Mulberry fruit is rich in carotene, vitamins B1, B2 and C, glucose, sucrose, tartaric acid and succinic acid. Mulberry fruits also are rich in anthocyanins which a good potential to be researched in depth to be an alternative option of natural food colouring which is healthier and safer for consumers.

Sánchez-salcedo, Amorós, Hernández, & Martínez (2017) in their studies suggested that Spanish mulberry leaves clones could serves as a cheap resource of minerals, protein and crude fibre. Therefore, it can be act as a feed additive. While in Kuwahara et al. (2020) findings, it was indicate eating snacks alongside mulberry leaves are an efficient way to suppress postprandial high glucose levels in young adults with high glucose levels and lean body weights, and who prefer evenings.

There is a growing popularity over many natural products which is believed to guarantee a healthier and safer for health. Herbal tea, for instance, is starting to gain popularity among consumers. In order to prepare the decoction called mulberry tea, mulberry leaves are used. The leaves are delicate and diaphoretic. The anti-diabetic and cholesterol reduction characteristics of mulberry tea are immensely popular because it is believed as an alternative source for medicines. A leaf decoction is also used as a throat infection. Blood sugar is reduced, and arterial pressure is decreased due to the use of fresh or dried leaves of mulberry. Mulberry leaf juice keeps the skin clean, healthy and prevents discomfort and inflammation of the throat. (Buhroo et al., 2018).

Futhermore, there is an innovation has been made in producing Mulberry paratha as stated by Bhosale, Khyade, & Patil (2019). In their research, addition of the mulberry leaf powder and aqueous mulberry leaf extractives (AMLE) in the dough exert significant influence on the parathas with reference to anti oxidation.

MULBERRY AS MEDICINE

Buhroo et al. (2018) reported the mulberry root bark, particularly in the Asian regions, has been used in traditional medicine. Modern medicinal products with a clear pharmaceutical function have verified the therapeutic potential of products extracted from mulberry root bark. For example, the root bark of M. alba is used as medical treatment for cough, asthma and other diseases in Chinese medicine practitioners.

Various nutrients have been identified in the mulberry fruit such as fatty acids, amino acids, vitamins, minerals and bioactive compounds according to their cultivars and maturity phases. For example, anthocyanins, rutin, quercetin, chlorogenic acid and polysaccharides. Mulberry fruit extracts and its active ingredients has been evaluated for various kind of bioactivities, including antioxidant, neuroprotective, antiatherotic, immunomodulatory, antitumor, antihyperglycemic and hypolipidemic function. Many in vitro and in vivo studies reported on the listed bioactivities (Yuan & Zhao, 2017).

Moreover, in Gryn-Rynko, Bazylak, & Olszewska-Slonina (2016) studies, they found that the leaves of *Morus alba* L. could serve to many health problem including antidiabetic, antibacterial, anticancer, cardiovascular, hypolipi-demic, antioxidant, antiatherogenic and anti-inflammatory properties. Hussain, Rana, Shafique, Malik, & Hussain (2017) found that the aqueous, methanolic, and ethanolic extracts of Morus species and their bioactive compounds play a significant role as anti-oxidative, anti-diabetic, anti-stress, nephroprotective, antimicrobial, anti-mutagenic, anticancer, anxiolytic, hepatoprotective, anthelmintic, antimicrobial, immune-modulatory and cholesterol lowering effects. It was also supported by Lim & Choi (2019) in their findings suggest that *M. nigra* can be used as a promising nutraceutical resource to control and prevent various chronic diseases.

Through a controlled study by Doğan, Can, & Meral (2017), the evidence indicated that the efficient procedure for preventing oral radiation mucositis in patients with head and neck cancer may be black mulberry molasses.

MULBERRY FOR LANDSCAPE

Mulberry trees are used for landscaping in Asia, Southern Europe and the southern U.S.A. (Tipton, 1994). Their resistance to pruning and their low water requirements make them very suitable for urban plants. Mulberry trees are part of the urban landscaping in Arak, Iran (Taghizadeh M, 2019). Fan, Xie, Wei, Ni, & Yang (2015) reported an effective management for soil and water conservation and environmental sustainability in the Three Gorges Reservoir Region. They suggested the potential usage of mulberry hedgerow system on sloping lands.

MULBERRY AS ANIMAL FEED

The mulberry foliage is highly nutritious and palatable and commonly used to feed silkworms and other animals such as ruminants. All species of mulberry, in particular *M. alba* are useful plants which combine good nutritional composition with characteristic agronomic characteristics. *M. Alba*'s are excellent and have a CP content of >20% DM as stated by Valdes, L. L. S., Borroto, O. G., & Perez (2017). The amino acid composition is similar in *M. Alba* to soy meal, which is a synonymous amino acid source, with a half necessary amino acids. Depending on the fertility of the soil, the total ash content can be greater than 15%, but typically from 10 to 15%. The leaves contain substantial quantities of macro and microelements and the cell idioblasts contain significant calcium accumulation. Morus species are recognized as forage sources because for some solid reasons including the high biomass production, chemical composition, high ruminal degradability, adaptability to different climate and soil conditions, as well as availability (Valdes, L. L. S., Borroto, O. G., & Perez, 2017). Cai et al. (2019) suggested the idea of processing the mulberry to feed the animals especially during winter and spring due to the high-quality protein in the mulberry. These ideas could overcome the pollution due to combustion. In fact, this will lead to a safer and sustainable livestock production which in long term benefit to the economic growth, social and ecological in China and other countries as well. Thus, it is highly probable that mulberry leaves would be cultivated and used as animal and poultry feed. Chandrashekhar & Hj (2020) studies also proved that due to the high crude protein in mulberry silage, the mulberry leaf is a good sheep foodstuff which makes it superior to other forage crops. Moreover, according to Hao et al. (2021) Paper Mulberry (*Broussonetia papyrifera*, PM) is high protein and can be used as a new roughage feedstuff.

Zhao et al. (2020) have investigated the effects of mulberry leaf polysaccharide (MLP) on weanling pigs. From that study, animals' metabolisms and the immune parameters of weanling pigs supplemented with dietary MLP were significantly better. While in Chen et al. (2020) studies, it was proven that *B. papyrifera* leaf extract supplementation at a certain dose can increase growth and weaned piglets antioxidant capability, reduce diarrhea, boost immune functions and resistance to disease and affect fecal microflora's composition.

In sericulture activity, mulberry leaves are mainly used to feed the silkworm. The mulberry silkworm, *Bombyx mori*, is a domesticated and monophagous insect, which feeds only on the leaves of mulberry (Ahmed, 2019). The silkworms that consumed leaves of Kenmochihi (*Morus bombycis*) had better performance (Alipanah, Abedian, Nasiri, & Sarjamei, 2020). They also performed better for traits of cocoon shell weight, feed efficiency to cocoon shell weight, and feed efficiency to cocoon weight.

MULBERRY POTENTIAL IN COSMETIC INDUSTRY

The production of silk yarn requires of *Bombyx mori* silkworm rearing and commonly fed with the mulberry foliage. The identified richness of proteins including threonine, arginine, asparagine, serine, and glutamine in mulberry leaves makes it to be the a good sources of amino acids for the silkworm growth (Krajnc et al., 2019). Generally, the silk protein (fibroin and sericin) is derived from the converted protein in the mulberry leaf by the silkworm (Ghosh, Gangopadhyay, & Chowdhury, 2017).

Sericin is simply derived by detaching it from the fibroin part in silk. During silk production, sericin needs to be removed because only fibroin will be used. This process will let the sericin to be discarded in the effluent which may cause environmental issue. Restoration of sericin can reduce the load in effluent which later avoid the environmental risk (Lalit Jajpura, 2015). Another idea is by using sericin as a main ingredient in producing a new green cosmetic product since Swidi, Wie, Hassan, Hosam, & Kassim (2010) stated that cosmetics and toiletries in Malaysia experienced marginally stronger growth due to a range of new product releases that attracted customers and increasing during the last few years to be 40% from Malaysian Ringgit (MYR) 1.4 billion in 1995 to MYR 1.9 billion in 2007 also projecting sales volume to hit $1.1 billion by 2010. Moreover, according to Gerstle (2016) in 2015, Malaysia's total personal care and cosmetic trade amount was around US$2.24 billion while over 50% of this amount which is US$1.13 billion was met in imports, in which the major exporters are South Korea, Japan, Spain, Italy, Australia, United States, France, New Zealand and Switzerland. In addition, skin-care products played a role as the main driver of the market share with US$292 million total import value, followed by cosmetics and toiletries with US$109 million and skin-wash products valued at US$104 million. This growing demand offers a good opportunity for cosmetic industry in producing a new product of silk-based.

Kitisin, Maneekan, & Luplertlop (2013) investigated an anti-aging property of silk sericin by *in-vitro* characterization using fibroblast cell culture model. They claimed the ability of silk sericin to stimulate collagen type I synthesis and also to suppress the regulation of nitrite. The anti-aging properties of Sericin were equivalent to vitamin C with superior oxidative stress in silk sericin. The findings show that silk sericin has anti-aging properties and provides added value that can be incorporated into good quality and sustainable cosmetics and supplements.

There is currently an initiative in Malaysia to encourage mulberry cultivation, as stated by Saikim et al (2017). The Sabah Mulberry Knowledge Transfer Program showed changes in rural poor livelihoods through a combination of increased wages, improved basic needs and services, easier access to knowledge and increased understanding of the protective role of total mulberry flavonoids. In order to increase production and ensure the sustainability of sericulture, new areas should be identified, and existing production areas rehabilitated, enabling mulberry production areas to be extended so that they can cooperate with a new industry, such as the cosmetics industry.

CONCLUSION

Woody plants of mulberry have been explored to contribute its great potential in various fields including agriculture, pharmaceutical and food as well as in cosmetic industries. If the product from sericulture could be enhanced for its potential in producing cosmetic product in Malaysia, it can encourage more farmers to cultivate mulberry trees and produce silkworm to provide sericin as a raw material in producing sustainable green cosmetic. Through the innovation occurred in the mulberry industry to be as a food supplier for the silkworm industry will increased the scale of mulberry trees cultivation to be higher than before and contributed to the improvement of plantation industry. Therefore, cosmetic industry could be one of the options to be explored to obtain the benefit of integrating between the production of mulberry and silkworm in Malaysia.

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