

## Antitumoral Properties of Xanthones from Mangosteen (*Garcinia Mangostana L.*) Hull


 Short  
Review
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### ABSTRACT

Mangosteen is known as “the queen of fruits” in Malaysia, and the fruit is usually available during seasons from June to August yearly. This fruit comprises substantial amount of hull which disposes off as waste. However, it is the hull that has been discovered having various pharmaceutical properties such as antioxidant, anti-inflammatory, and antitumoral. The sudden surge of antitumoral properties studies of mangosteen hull in recent years is due to the rising of cancer which is the leading cause of death worldwide. This review highlights the recent discoveries of antitumoral properties of mangosteen hull. The major xanthones isolated from mangosteen hull which attribute to antitumoral properties are  $\alpha$ -mangostin and  $\gamma$ -mangostin. They have been majorly discovered against cancers of colon, breast, and leukemia, followed by skin, bone, lung, brain, pancreatic, prostate, and head and neck.

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## 1. Introduction

Mangosteen (*Garcinia mangostana L.*), is a large tropical evergreen tree from the *Guttiferae* family with a straight trunk, and it takes almost 6 to 7 years to cultivate before it fruits [1]. The fruit comprises of 25-29% of edible flesh, 60-65% of hull, and 6-10% of seed [2]. Its sweet and mild sour delicious pulp are the contributing factors for its popularity among the tropical fruits. Mangosteen has become an economically important species in recent decades since it is popular to Western Europe and United States most probably because of its pharmaceutical properties discovery, especially antitumoral [3-4]. As reported by World Health Organization, cancer is the leading cause of death worldwide and accounted for 7.6 million deaths (around 13% of all deaths) in 2008 [5]. Mangosteen is the local seasonal fruit of Malaysia, which the delicious pulp is a target by local but the deep reddish purple hull (exocarp) is disposed as waste. The hull which contains bioactive compounds of xanthones has been widely discovered having various pharmaceutical properties. Among the xanthones,  $\alpha$ -mangostin is the most extensively discovered having inhibition capabilities against various cancer cells. This paper discusses the recent discoveries and research trend of antitumoral properties of  $\alpha$ -mangostin on various

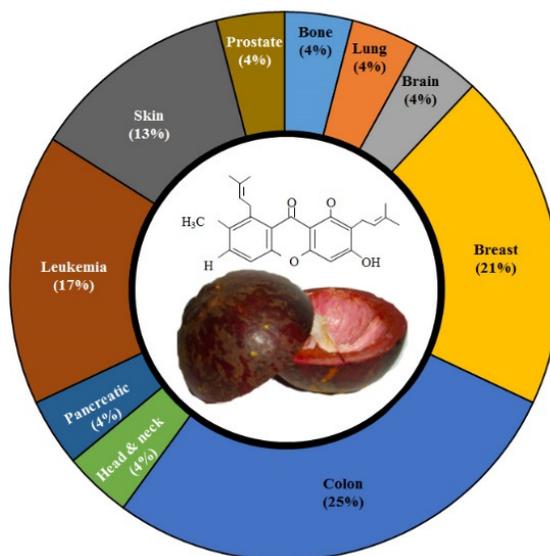
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cancer cells. The  $\gamma$ -mangostin and other xanthenes which have been proven as potential anticancer agents are also highlighted.

## 2. The $\alpha$ -Mangostin

The most abundant xanthone found in mangosteen hull is the  $\alpha$ -mangostin [6-7].  $\alpha$ -mangostin is one of the earliest naturally occurring xanthone isolated from mangosteen hull using gas chromatography [8]. Numerous studies have revealed that the  $\alpha$ -mangostin not only possesses properties of antioxidant, anticancer, anti-inflammatory, anti-allergy, antimicrobial, and antiparasitic, it also has potential for anti-obesity and treatment of Alzheimer's disease [9]. Within the many pharmaceutical properties, its antitumor capabilities against various cancer cells have been extensively researched in recent decades. **Fig. 1** illustrates recent scientific findings of antitumoral properties of  $\alpha$ -mangostin against various cancer cells. Approximately 25% of previous studies have proven the inhibition capabilities of  $\alpha$ -mangostin against colon cancer cells as shown in **Fig. 1**. Its inhibition effects on other cancer cells such as breast cancer, leukemia, skin cancer, prostate, bone, lung, brain, pancreatic, head and neck have also been investigated and discovered.



**Fig. 1.** Recent discoveries of antitumoral properties of  $\alpha$ -mangostin on various cancers

**Fig. 2** demonstrates the trend of antitumoral properties discovery of  $\alpha$ -mangostin from 2000 to 2014. The earliest finding on antitumoral properties of  $\alpha$ -mangostin were on leukemia [10-11] and colon [12-13] cell lines from 2003 to 2005. For the period from 2006 to 2010,  $\alpha$ -mangostin's inhibition effects against breast cancer [14-16], prostate [17], and lung [18] was reported. Most recently from year 2011 to 2014, the finding of  $\alpha$ -mangostin's inhibition for cancer cells have extended to bone [19], brain [20], skin [21-23], pancreatic [24], head and neck [25], apart from breast cancer [26-27]. It is noteworthy that  $\alpha$ -mangostin has been extensively discovered its inhibition ability against colon cancer cell lines [28-29] for a decade.

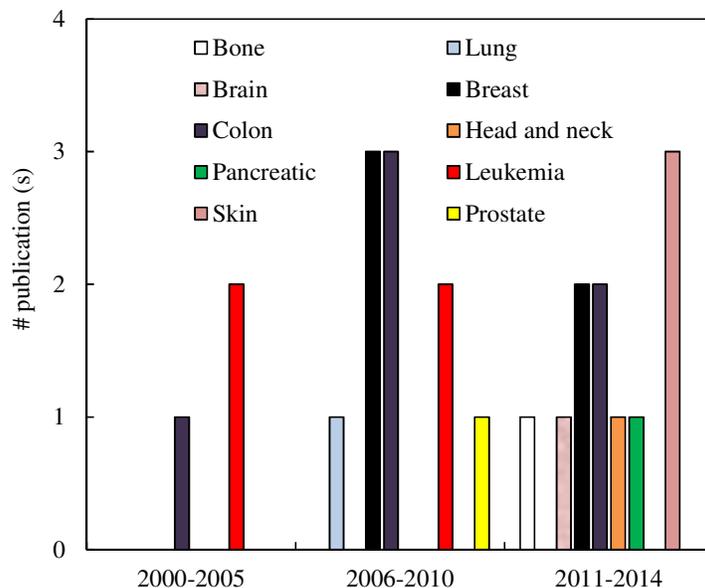


Fig. 2: Research trend of antitumoral properties of  $\alpha$ -mangostin derived from mangosteen hull

### 3. The $\gamma$ -Mangostin and other Xanthenes

The  $\gamma$ -mangostin is another xanthone derived from mangosteen hull and for its widely studied pharmaceutical property. It appears as a paleyellow powder after isolation with a thin layer chromatography [30]. The  $\gamma$ -mangostin isolated from mangosteen hull has been discovered to have antitumoral property against leukemia [10, 31], breast cancer [14], skin [21], and colon cancer [28, 32].

Further to this, the 1,3,6,7-tetrahydroxy-2,8-(3-methyl-2-butenyl) xanthone and epicatechin that were studied and tested *in vitro* also showed good cytotoxicities against human breast and colon cancer cells [33]. Both have been suggested as potential anticancer agents [33]. Other two newly identified xanthenes, the tetrahydroxanthone and garcimangosxanthone were revealed to exhibit *in vitro* cytotoxicity against human lung cancer, pulmonary carcinoma, and hepatoma [34]. More recently, xanthone of 8-deoxygartanin derived from mangosteen pericarp has been discovered having cytotoxicity against skin cancer [21].

### 4. Conclusion

Cancer, as the leading cause of death worldwide in recent decades, has triggered the quest of plant materials which contain potential antitumoral properties to combat the disease. The  $\alpha$ -mangostin derived from mangosteen has natural occurring bioactive compounds which is anti-cancer. The recent research trend on the discovery of this compound provides an insight for scientists or researchers to further explore its inhibition capabilities against more cancer cell lines.

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