1. INTRODUCTION

Brassica sp. vegetables are one of the most consumed and popular vegetables in Indonesia. Production of some *Brassica* vegetables, like cabbage, broccoli, and mustard green, are around 400 to 1400 tons/year (Badan Pusat Statistik Republik Indonesia, 2010). Vegetables are easily spoiled and lost their freshness mostly caused by post harvest handling. To increase the shelf life, some processing methods can be used. One processing that has been commonly practiced in Indonesia is fermentation. One example of fermented products of *Brassica* sp. is *sayur asin*. This fermented product not only consumed in Indonesia but also in other countries, like Thailand (so-called: *Pak Kard Dong*) and China (so-called: *Hum Choy*) (Robin and Chiou, 2003).

Sayur asin is commonly made from Indian mustard or local name: *sawi pahit* (*Brassica juncea* var. Czern) which is fermented (naturally) by lactic acid bacteria (Robin and Chiou, 2003). Unlike other vegetables, *Brassica* sp., almost exclusively contain glucosinolates. Glucosinolates are group of β-thioglucoside N-hydroxyiminosulfate esters, which have sulfur linked β-D-glucopyranose moiety and a side chain on an α-carbon of the imino group. Hydrolysis of glucosinolates can produce for examples: isothiocyanates and indole-3-carbinol, which are capable to modulate biotransformation enzyme activity and prevent certain cancers (Bheemreddy and Jeffery, 2006).

Glucosinolates was the defend system of plants from insect or rodents, and it has a toxic effect for insect and rodents, also for human, it can cause the swallowing of thyroid for some dosage. Sinigrin was the highest glucosinolate on Indian mustard seed. Some studies on sinigrin in Indian mustard seeds found that sinigrin was a good precursor of the anticancer compound (allyl isothiocyanate). Sinigrin has been used as a nutrition suplement to prevent and as a medicine for some cancer and diseases because of its pharmacological activity such as anticancer and antimicrobial activity. Oral dosage consumption of sinigrin which can inhibit cancer growth to 34.5% was 9 µmol/kg. Nowadays, research on health effect of sinigrine found that it can inhibit growth of some cancer (bladder cancer, liver cancer, and colorectal

cancer), increase the detoxication enzymes, have an anti-SARS effect, inhibit tumor cell poliferation, and decrease the hypertriglyceridemia (Krul, *et al*., 2002; Norton, 2012; Patel *et al*., 2012)

However, treatments along the production chain of the vegetables, including storage and processing, may reduce glucosinolates and other bioactive compounds levels as reported in the previous studies about fermented *Brassica* sp. *i.e*: kimchi and sauerkraut (Harbaum *et al*., 2008; Suzuki *et al*., 2006). There is no study yet on the glucosinolate's changes during the production of sayur asin. The production of *sayur asin* is commonly found in home industry. So, there is no standarization for the *sayur asin* making process. Many variations, such as media or salt content, may give some effects in glucosinolates content and physicochemical properties during fermentation.

Based on previous studies, both of different concentration of NaCl and media type, affected the physical appearance of fermented Indian mustard like color, aroma, taste and for salt concentration are also affected to fermentation process. Sadek *et al* (2009) and Pradani and Hariastuti (2009) reported that using higher concentraton of salt (5% or 10%) could delay the fermentation process more, so the end product will have higher pH and also different color compared with lower salt concentration (3%). While differences in media types (either boiled rice water/*tajin* or coconut water), based on interview and observation also gave a different result. It was found that *tajin* made the end product has a lower pH and more acid taste, while the color was more yellowish as compared to boiled rice water. This finding was also supported by previous study of Nugerahani *et al* (2000).

Previous studies in *sayur asin* have been focused on lactic acid bacteria. Puspito and Fleed (1985) found that for natural fermentation, the quality of final product will be influenced by the growth of microbial species. Lactic acid bacteria that have been found in fermented Indian mustard were: *Leuc. mesenteroides*, *L. confusus*, *P. pentosaceus*, *L. curvatus*, and *L. plantarum*. The highest amount was *L. plantarum*. Evelyne *et al* (2011) reported that lactic acid bacteria which are found in fermented Indian mustard had probiotic properties. These

were resistant to bile salt (up to 0,5%), acid environment (pH 7 and 3), and have antimicrobial activity (against *E. coli* and *Staphilococcus aureus*). The highest probiotic activity in lactic acid bacteria were found in *Lactobacillus paltarum* and *Lactobacillus pentosus*.

The present study will therefore examine the effect of each step of *sayur asin* making, different media usage, and salt content to the changes of glucosinolates and the physicochemical properties of *sayur asin*.