CHAPTER I
INTRODUCTION

The Maillard reaction was first declared in 1912 by Louis-Camille Maillard who has been described that upon gently heating sugars and amino acids in water will generate a yellow-brown color (Bastos et al., 2011). Maillard reaction has been well understood as a non-enzymatic reaction between reducing sugars and amino acids to generate the Maillard reaction products (MRPs). In several food industries, Maillard reaction products were a desirable process to generate the flavor, color, and antioxidant activity (Phisut and Jirapon, 2013; Hwang et al., 2011). The application of food processing practices to generate MRPs can improve the oxidative stability of food products and preserve food from oxidation and microorganism contamination as well (Sun et al., 2004b). Moreover, the typical characteristics of MRPs' flavor and antioxidative properties, denote another major category of volatile components (Imafidon and Spanier, 1994) that might lead to reduce or neutralize the off-flavor in foods which are less favored by some people, such as fresh milk, fish and meat. Based on this thing, the important role of MRPs in the food industry can be continued to develop. Therefore, several factors in the reaction to generate MRPs, which are reactants type and concentration, temperature, heating time, pH, and humidity (Lamberts et al., 2008; Hwang et al., 2011) could not be disregarded. It is generally concluded that reactants and reaction conditions truly affect the result of final Maillard reaction products (Delgado-Andrade et al., 2004).

MRPs can be modified according to the reactant, temperature and heating time, pH, and water activity (Delgado-Andrade et al., 2005). A temperature has been stated as an important key for producing MRPs. It has been recognized that significant increase of MRPs was obtained after an increase of temperature from 50 to 60^{o}C (Alvarenga et al., 2014), thus resulting in the conclusion that MRPs was temperature-dependent products. As has been mentioned previously by Alvarenga et al. (2014), reducing sugars and amino acids serve as reactants that are required to generate MRPs. These type of reducing sugars and amino acids can be modified to generate an optimal MRPs, and some experiments of it have been studied using rare sugars (Sun et al., 2006). One example of a reducing sugar is a rare sugar D-psicose which categorized as ketohexose that may be produced by the enzymatic reaction using D-tagatose 3-epimerase from D-fructose (Sun et al., 2004a). D-psicose has been categorized as rare sugars since it is scarcely found in nature. Though D-psicose has 70% of the sweetness of sucrose, the reactivity to proteins may produce foods with excellent antioxidant activity and good rheological properties (Oshima et al., 2014a; Puangmanee et al., 2008; Sun et al., 2006).

In the other hand, a reactive amino acid is needed as well to produce an optimum MRPs, such as methionine. Methionine is an essential amino acid that usually used in the food industry to produce aroma compounds such as cooked potatoes, coffee, roasted meat, and may lead to contribute to produce MRPs when it has interactions with reducing sugars through thermal conditions (Pfeifer and Kroh, 2010). The previous study from Pfeifer and Kroh (2010) also stated that

methionine has great effect on the formation of specific R-dicarbonyl compounds in Maillard reaction.

The non-enzymatic browning reaction derived from methionine and D-glucose has been evaluated previously (Ajandouz and Puigserver, 1999), but based on recent study, few document was found on Maillard reaction products from methionine and D-psicose. The previous research studied browning color intensity of the D-psicose and non-polar amino acids mixtures at high temperature but none was found when the mixture was applied in minimum/low temperature. Therefore, the objectives of this present study are to demonstrate the MRPs generated from D-psicose and methionine (Psi-Met) at low temperature. We investigated the browning intensity, color development, spectra measurement, ABTS radical scavenging activity, and the correlation between browning intensity and scavenging activity of MRPs derived by heating process. This finding may provide beneficial information of D-psicose and MRPs for the next scientific research, and may provide beneficial information of D-psicose to the food industries which applies MRPs in their products.