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ABSTRACT

Fats and oils has limited applications in food industry in their natural form and need to be modified. Fat modification technique such as hydrogenation produced *trans* fatty acids which is one of the factor that increase the risk of heart disease. The aims of this study were to determine the effects of chemical interesterification on physicochemical properties of palm stearin, palm kernel oil and rice bran oil blends and to optimise a fat blend for *trans*-free margarine that contained bioactive compounds without sacrificing the functional properties. A total of 10 blends of palm stearin (PS), palm kernel oil (PKO) and rice bran oil (RBO) were formulated using a mixture design based on simplex-lattice (Design Expert 9.0 Stat-Ease Inc., Minneapolis, 2014) and subjected to chemical interesterification (CIE) using sodium methoxide as catalyst. The original and interesterified blends were examined for fatty acid and triacylglycerol (TAG) composition, slip melting point (SMP), solid fat content (SFC), ternary phase behaviour, thermal properties, crystallisation kinetics, polymorphism, microstructure, hardness and bioactive compounds content. Fatty acid and TAG composition of the blends were dependent on the proportion of PS, PKO and RBO in the blend. For example, in 4PS:PKO:RBO blend, palmitic and oleic acid which are the major fatty acid in PS were the highest with 33.35 % and 38.54 %, respectively. There was no *trans* fatty acid presence in the blends before and after CIE. Based on the results, random rearrangement of fatty acid on glycerol backbone after CIE caused changes in the triacylglycerol composition which in turn affect the physical properties. The slip melting points of all blends significantly reduced ($p<0.05$) after CIE except for CIE PS and CIE PKO:RBO. The SFC of all CIE blends were reduced at all measured temperatures except for CIE PS and CIE PKO. The analysis of ternary phase showed that eutectic behaviour reduced after CIE. Chemical interesterification significantly ($p<0.05$) modified the DSC melting and crystallisation properties with all the interesterified blend had lower complete melting temperature and initial crystallisation temperature than their respective non-interesterifed blends except for CIE RBO. No changes in polymorphic form of the blends after CIE except for PKO and its binary blends where β′ crystal became dominant. Chemical interesterification also modifies the microstructure of the blends in term of size and shape where the crystals were smaller, finer and loosely packed. After CIE, there were significant reduction ($p<0.05$) in bioactive compunds like tocols, sterols and oryzanols where the reduction ranged from 65.2 to 20.2 %, 43.1 to 9.6 % and 15.5 to 8.8 %, respectively. From analysis of multiple isosolid diagrams, an optimum blend of (22:16:62) PS:PKO:RBO was obtained. The optimum blends displayed characteristics suitable for production of soft margarine with bioactive compounds, offering alternatives to partly hydrogenated which will help reduced *trans* fat consumption. Moreover, the fat blend obtained will optimise the usage of palm stearin, palm kernel oil and rice bran oil in food application as these fats and oils have limited applications in their natural form.

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