

New insights on degumming and bleaching process parameters on the formation of 3-monochloropropane-1,2-diol esters and glycidyl esters in refined, bleached, deodorized palm oil

ABSTRACT

This paper examines the interactions of degumming and bleaching processes as well as their influences on the formation of 3-monochloropropane-1,2-diol esters (3-MCPDE) and glycidyl esters in refined, bleached and deodorized palm oil by using D-optimal design. Water degumming effectively reduced the 3-MCPDE content up to 50%. Acid activated bleaching earth had a greater effect on 3-MCPDE reduction compared to natural bleaching earth and acid activated bleaching earth with neutral pH, indicating that performance and adsorption capacities of bleaching earth are the predominant factors in the removal of esters, rather than its acidity profile. The combination of high dosage phosphoric acid during degumming with the use of acid activated bleaching earth eliminated almost all glycidyl esters during refining. Besides, the effects of crude palm oil quality was assessed and it was found that the quality of crude palm oil determines the level of formation of 3-MCPDE and glycidyl esters in palm oil during the high temperature deodorization step of physical refining process. Poor quality crude palm oil has strong impact towards 3-MCPDE and glycidyl esters formation due to the intrinsic components present within. The findings are useful to palm oil refining industry in choosing raw materials as an input during the refining process.

Keyword: 3-MCPD esters; Glycidyl esters; Crude palm oil; D-optimal design; Water degumming; Acid activated bleaching earth.