

Reduction of Persistent Organic Pollutants in Fish Oil by Short Path Distillation – Process Optimization and Effect on Oil Quality

Åge Oterhals^{1*} and Marc H.G. Berntssen²

¹Nofima Ingrediens, Bergen, Norway

²NIFES, Bergen, Norway

*Corresponding author: aage.oterhals@nofima.no

Alkali refined and bleached fish oil was processed by use of a KD6 short path distillation pilot plant (UIC, Germany). A 3-factorial experimental design based on temperature range 172-228 °C, feed rate 2.3-7.8 kg/h and addition of 4% “working fluid” (WF; fatty acid ethyl esters) was used to optimize the decontamination process. Decontamination effect was assessed by measuring the level of 17 dioxins [polychlorinated dibenzo-*p*-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs)] and 12 dioxin-like polychlorinated biphenyls (DL-PCBs) for which the World Health Organization (WHO) has established Toxic Equivalent Factors (TEF) for human risk assessment, as well as six polybrominated diphenylether (PBDE) flame retardants. Change in oil quality was assessed based on cholesterol and vitamin E, K and D levels, fatty acid composition and peroxide (PV) and anisidine value (AV). The experimental effects were analyzed based on response surface methodology.

Generally high temperature, low feed rate and WF addition improved the decontamination efficiency. The PCDD/F and DL-PCB levels (expressed as ng WHO-TEQ kg⁻¹) could be reduced by up to 94% without WF addition. Addition of WF improved the decontamination effect up to a level of 97-99%. Reduction of PBDE showed a similar pattern. Cholesterol, vitamin E, K and D levels were reduced by 0-70%, 0-64%, 0-82% and 0-42%, respectively and to a lesser degree compared to the studied POPs. The process conditions had no effect on the fatty acid composition. PV and AV values showed only minor changes.