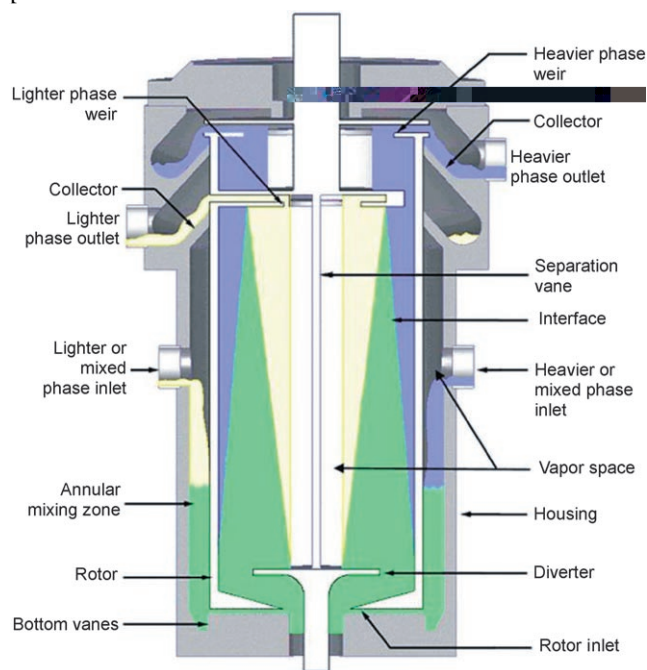
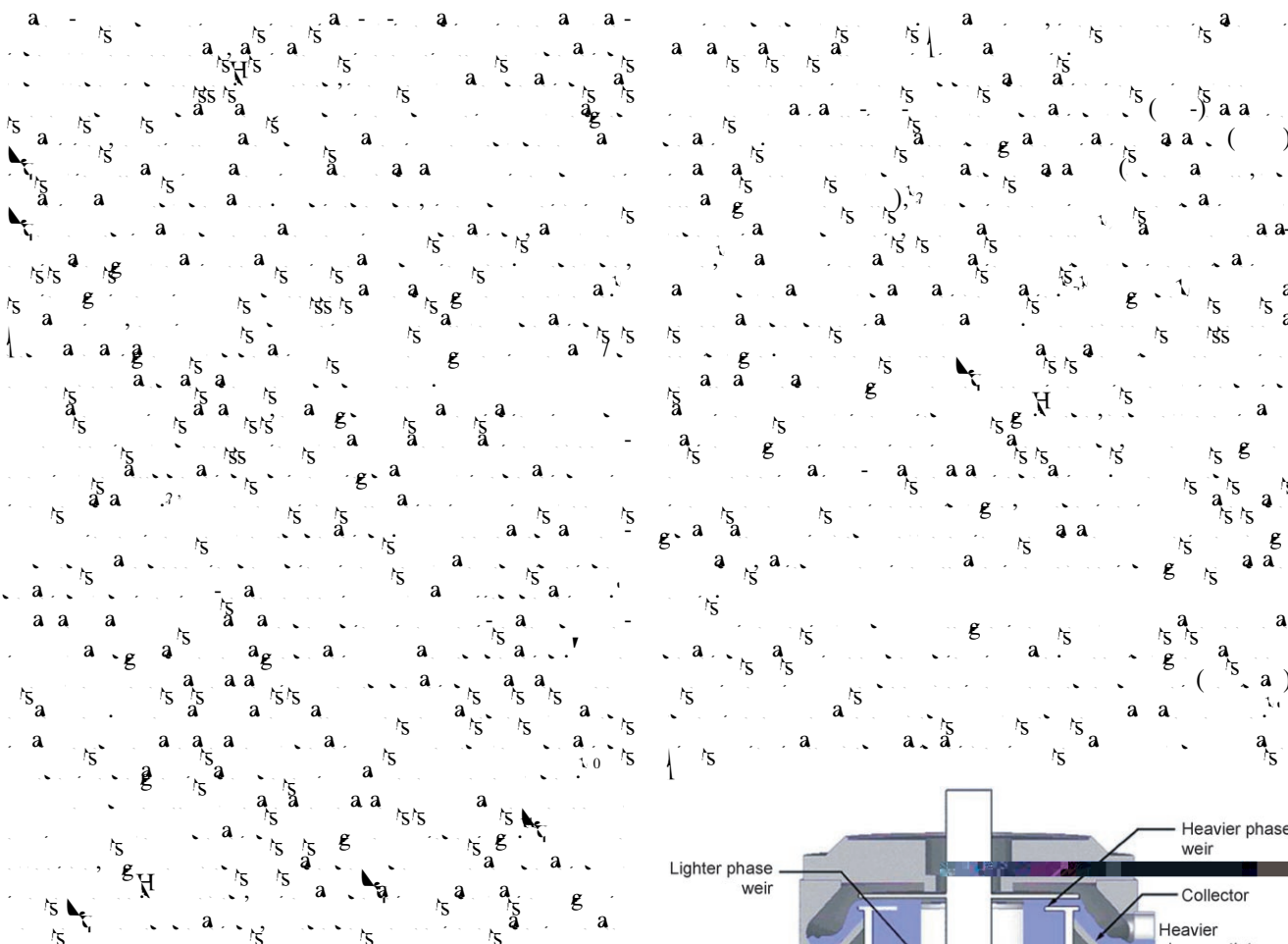


# Two-Phase (Bio)Catalytic Reactions in a Table-Top Centrifugal Contact Separator\*\*

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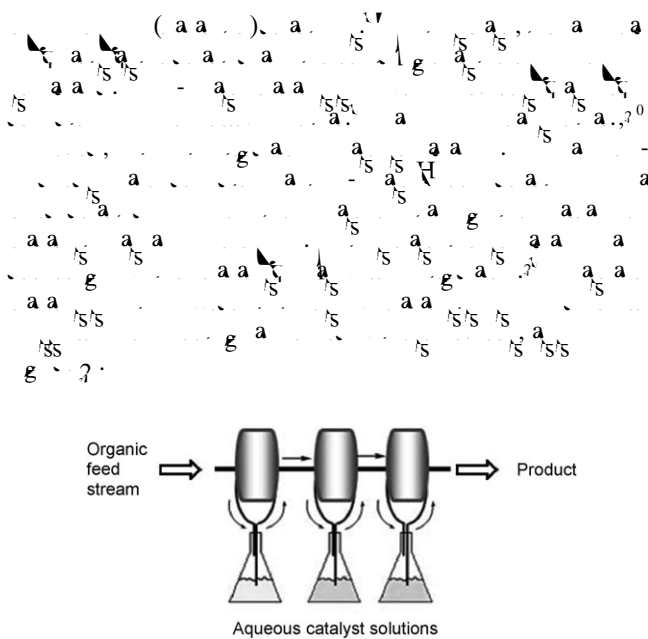
**Figure 1.** Schematic cross-section of a centrifugal contact separator (Courtesy of CINC-Solutions, The Netherlands).

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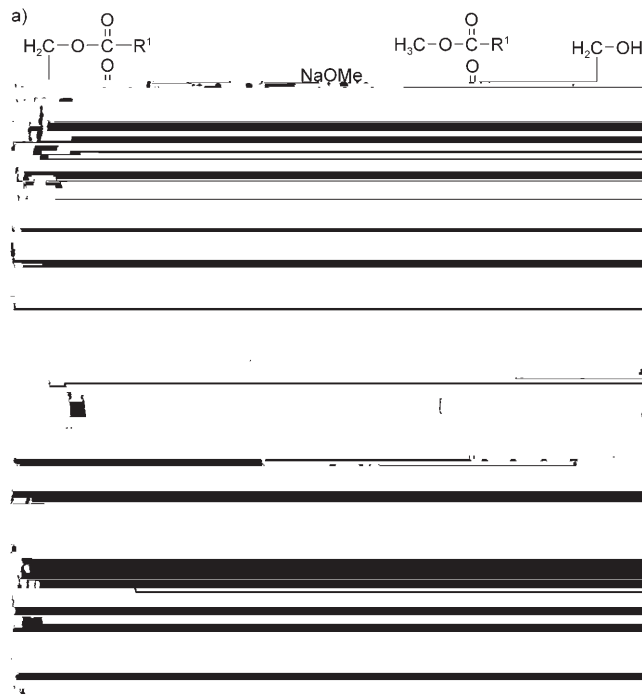
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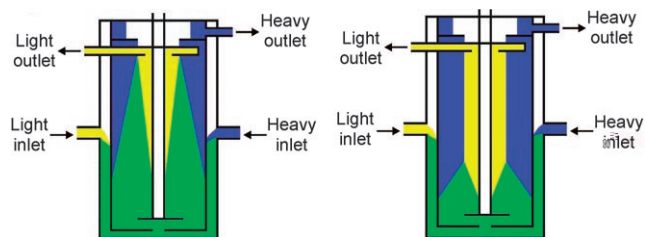
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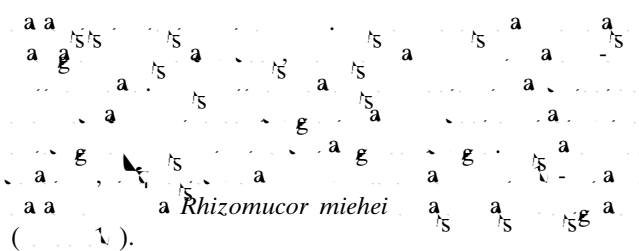
**Figure 2.** Cascade two-phase catalysis using CCSs in series.



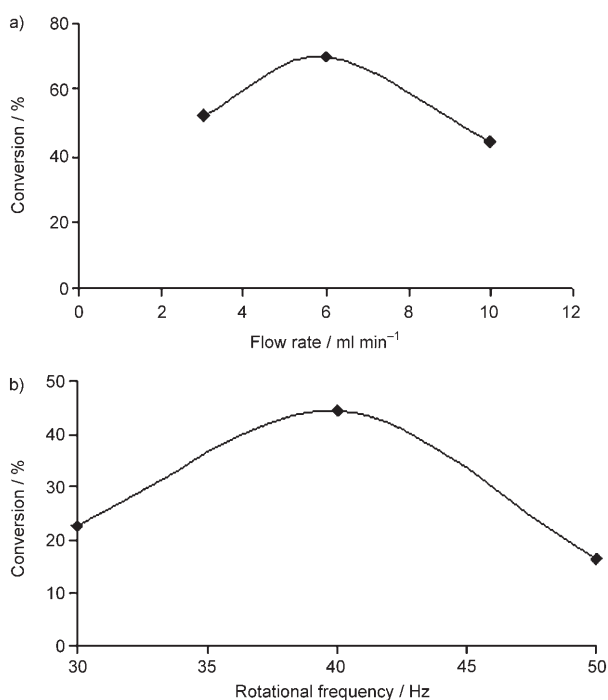
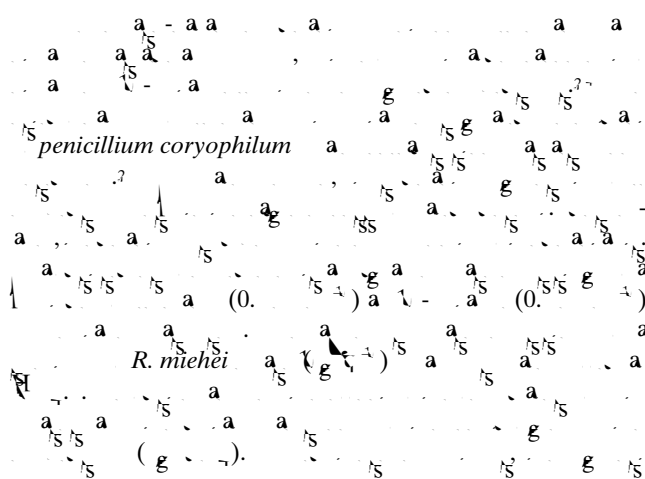
**Figure 3.** Continuous conversion (in duplicate) of sunflower oil into FAME in a CCS at 30 Hz.



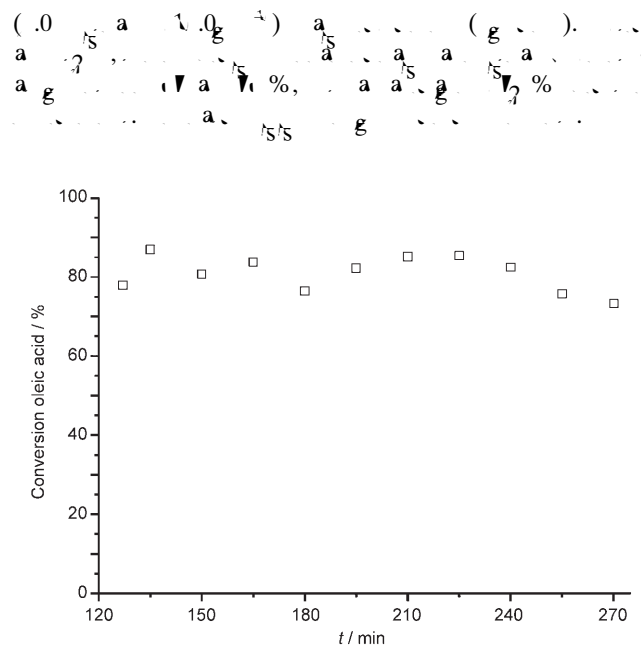
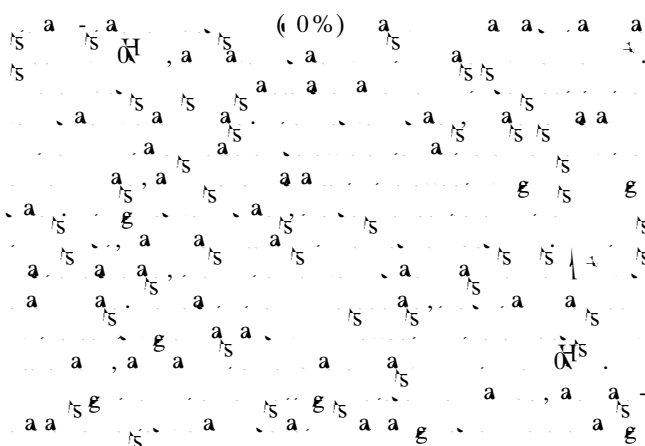
**Figure 4.** Liquid hold-up in the CCS at low- (left) and high-speed (right); blue = heavy phase, yellow = light phase, green = mixed phase.



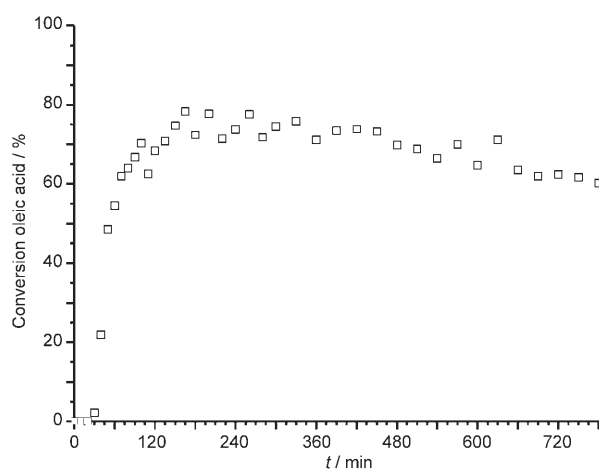
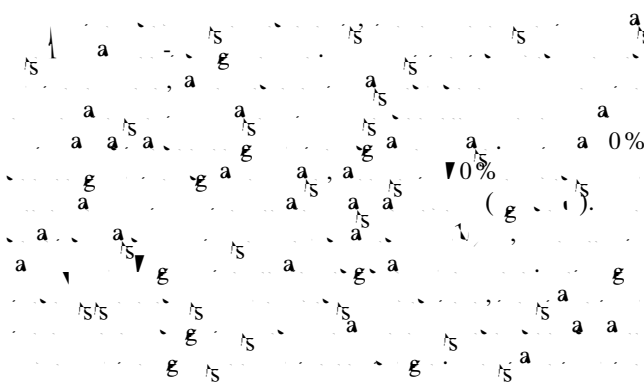
**Scheme 1.** Lipase-catalyzed esterification of oleic acid with 1-butanol.



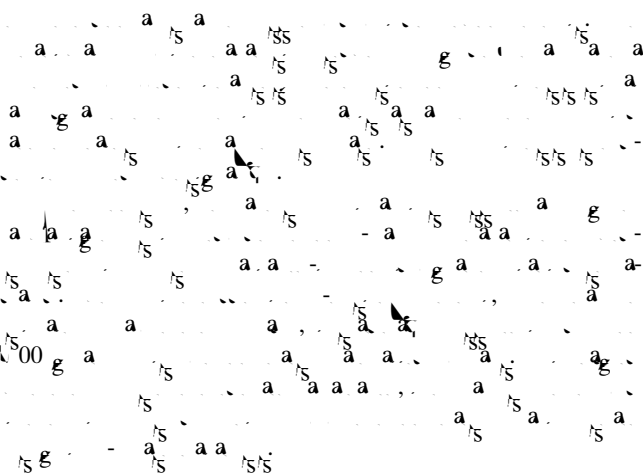
**Figure 5.** Effect of flow rate (a) and rotational speed (b) on the enzymatic esterification ([oleic acid]=0.6 M, [BuOH]=0.9 M, [lipase]=1 g L<sup>-1</sup>, T=50°C; a) rotational speed=40 Hz,  $\Phi_{\text{org}}=\Phi_{\text{aq}}$ ; b)  $\Phi_{\text{org}}=\Phi_{\text{aq}}=10 \text{ mL min}^{-1}$ ).



**Figure 6.** Lipase-catalyzed esterification of oleic acid with nBuOH in a CCS ([oleic acid]=0.6 M, [nBuOH]=0.9 M, [lipase]=3.0 g L<sup>-1</sup>,  $\Phi_{\text{org}}=\Phi_{\text{aq}}=6 \text{ mL min}^{-1}$ , spinning rate=40 Hz, T=50°C).



**Figure 7.** Lipase-catalyzed esterification of oleic acid with nBuOH in a CCS with full recycling of the water phase and 90% recycling of the heptane phase ([oleic acid]=0.6 M, [nBuOH]=0.9 M, [Lipase]=6.0 g L<sup>-1</sup>,  $\Phi_{\text{org}}=\Phi_{\text{aq}}=6.2 \text{ mL min}^{-1}$ , spinning rate=40 Hz, T=50°C).



## Experimental Section

... (a ... ) ...  
 ... ± 0.0 ...  
 ... (0. M) ... (0. M) ...  
 ... (0. M) ...  
 ... *Rhizomucor miehei* ...

**Keywords:** biphasic catalysis · enzyme catalysis · esterification · fatty acids · sustainable chemistry

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