Discriminative Analysis of Natural Waxes by Reactive Py-GC followed by Multivariate Analysis Method

[Background] Reactive Py-GC in the presence of an organic alkali, including tetramethylammonium hydroxide (TMAH), has been used as a rapid and highly sensitive technique for analyzing chemical composition of condensation polymers and natural organic materials. Moreover, detailed discriminative analysis among these polymers or organic materials can be often achieved by applying multivariate analysis methods, such as principal component analysis (PCA) and cluster analysis, to their chemical composition data obtained by reactive Py-GC. As an example of such a case, this note describes discriminative analysis among industrially-utilized waxes collected from the leaves at two different growing stages.

[Experimental] Two series of crude carnauba wax samples collected from the leaves of Cerifera palm tree in Brazil at two different growing stages were used. Series Y consisted of three waxes collected from younger, unopened heart leaves of the tree while series O consisted of three waxes from older, fully expanded leaves. About 30 µg of the cryo-milled wax sample was subjected to reactive Py-GC at 500ºC in the presence of 4 µl of 25wt% TMAH methanol solution. The resulting data from the observed pyrograms were processed using the principal component analysis (PCA) software, Ein Sight (InfoMetrix).

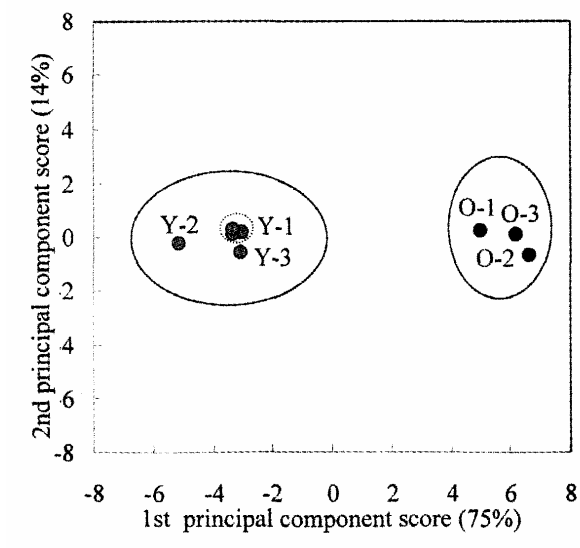

Figure 1. Discriminative analysis among carnauba wax samples collected from leaves at different growth stage.

[Results] On the pyrogram of each wax sample obtained by reactive Py-GC using TMAH, a series of the methyl derivatives of acid and alcohol constituents of carnauba wax were clearly observed as well-resolved peaks. Based on the peak intensities, chemical compositions of the wax samples were precisely determined. Furthermore, PCA was applied to the data set of chemical composition (the major 33 components) for the six carnauba wax samples in order to visualize the difference among these waxes collected from different growth stages of leaves. Figure 1 shows the relationship between the 1st and 2nd principal component scores for the wax samples. As shown here, the two dimensional plot for these carnauba waxes clearly indicated the distinction between the two different groups reflecting their growth stages of the leaves from which waxes had been collected.

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