

Application of Fast Neutron Activation Analysis in Food Safety

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The 14 MeV neutron activation analysis method based on portable D-T neutron generator is used in various industrial and research areas such as oil well logging, online detection of coal elements and neutron radiography. Flour and flour products are the staple food of China, especially the northern residents. However, there are also unscrupulous manufacturers who make a lot of talc powder into the flour, which seriously endangers people's health.

The chemical formula of talc is $Mg_3Si_4O_{10}(OH)_2$ while the major elements of flour are H, C, O, N. The content of talc in flour can be measured by counting characteristic γ ray produced by (n, p) reaction of 14 MeV neutrons with ^{28}Si and ^{24}Mg . The samples were irradiated for 1 hour and the measurement time was divided into two sections: the first 10 minutes for 1779 keV produced by ^{28}Al and the following 1 hour for 1369/2754 keV produced by ^{24}Na .

3-inch NaI(Tl) detector and 2-inch LaBr₃(Ce) detector were used to measure characteristic gamma rays at the same time. 3-inch NaI(Tl) detector was better in measurement because 3-inch NaI(Tl) is superior to 2-inch LaBr₃(Ce) detector in detection efficiency and background radiation interference. When the neutron yield of D-T neutron generator is 1.32×10^7 n·s⁻¹, the linear correlation coefficient between talcum content and characteristic peak counts reaches 99%. The optimal measurement method is that the sample mass thickness is set to $5.86 \text{ g} \cdot \text{cm}^{-2}$, and 1779 keV peak is measured with 3-inch NaI(Tl) detector. At this time, the minimum relative standard deviation for multiple measurements to the same sample is 2.07%, and the low limit of detection is 0.07%.

Abstract Type

Talk

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