

日本薬局方重金属試験法における呈色反応の定量化

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Quantification of Color Reaction in Heavy Metals Limit Test in Japanese Pharmacopoeia

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Summary

The Heavy Metals Limit Test in the Japanese Pharmacopoeia employs a conventional colorimetric method in which heavy metals generate a colored solution in the presence of sulfide ions. However, in this test, visual assessment requires a skilled and experienced experimenter; thus, a more objective assessment is required. Moreover, visual assessment is not quantitative; it is subjective, based on conformity or nonconformity.

The aim of this study was to evaluate a new photographic method to quantify the color reaction, using a general digital camera to record the results. The following heavy metals were evaluated: lead, bismuth, copper, antimony, cadmium, silver, mercury, arsenic, tin, and zinc. After reaction with sulfide ions, the test solutions were photographed at a downward angle over a white surface with a “color- and size-matching sticker”, which was of a standard color and size. Subsequently, each photographic image was transformed to obtain the actual color and size, as defined by CIE 1976 $L^*a^*b^*$, using image-editing software. Simultaneously, the test solutions were measured with a colorimeter or spectrophotometer for comparison with the photographic images. The color values based on photographs were in good agreement with the instrument measurements. This photographic method provides quantitative data on the color reactions.

Key words

Heavy metals, Japanese Pharmacopoeia, CIE 1976 $L^*a^*b^*$, Photograph, Colorimeter, Spectrophotometer