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Highlights of Analytical Chemistry in Switzerland

Detection of Carbon Monoxide-Treated Tuna by Headspace-Gas Chromatography/Mass Spectrometry

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In recent years sushi has become more and more popular in Switzerland, resulting in an increased demand for high quality raw fish such as tuna. A main criterion for freshness and quality of tuna flesh is its red colour. Under natural conditions, as a result of oxidation of myoglobin ($MbFe^{2+}$) to metmyoglobin ($MetMbFe^{3+}$) the colour rapidly turns an unattractive brown, particularly during frozen storage. For some years in Asian countries, *e.g.* Philippines and Indonesia, tuna fillets and loins have been treated with carbon monoxide (CO) or tasteless smoke, which contains CO. This treatment results in the stabilization of a bright red colour due to the higher affinity of CO for the Fe(ii) binding site of myoglobin. Thus, the muscle tissue is prevented from discolouration and its red colour lasts for an extended period of time. Even if the bright red of treated tuna looks rather artificial, consumers are attracted and product sales are increased.

CO is not approved as a food additive in Switzerland. Consequently, trading of foodstuffs treated with CO or tasteless smoke is prohibited by the Swiss food law. As CO-treated tuna retains its red colour even during spoilage, consumers may not only be deceived about product freshness but also are subject to a possible food poisoning due to the potential generation of biogenic amines.

We have implemented a fast and simple analytical method to test raw tuna for treatment with CO or tasteless smoke. First, myoglobin is extracted with ice water from the sample. Bound CO is then released from the extract by acidification and quantified using automated headspace gas chromatography/mass spectrometry.

To monitor the Swiss market, samples of raw tuna were collected from distributors and importers as well as by the border veterinarians and analysed for CO. In 21 of the samples collected in 2005, CO contents ranged from 29 to 177 µg/kg. These values are in agreement with indigenous CO contents in tuna as reported by other researchers. Furthermore, they are below the limit of 200 µg/kg which is proposed by Japan and EU member states for distinction of untreated from CO-treated tuna. However, six samples reached CO concentrations between 680 and 2430 µg/kg. These values are significantly above naturally occurring concentrations and indicated a treatment with CO or tasteless smoke. Consequently, these samples, all originating from the Philippines, were objected to by the responsible food control authorities.

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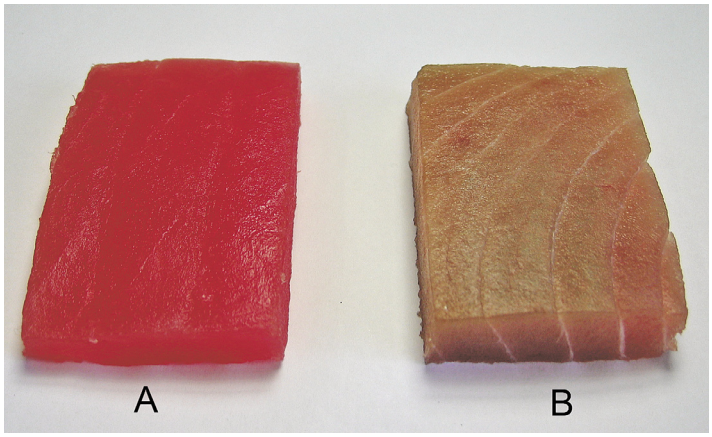
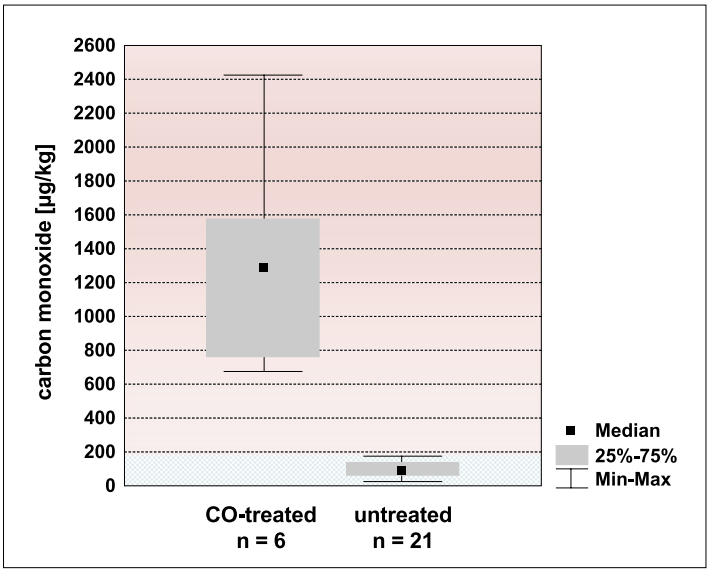
References:

http://www.kantonslabor-bs.ch/files/18/Jahresbericht.pdf



Different colours of carbon monoxide-treated (A) and untreated (B) tuna fillets after frozen storage



Clear distinction of untreated from CO-treated tuna samples by analysis of carbon monoxide content

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