ATTACHMENT
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AVA

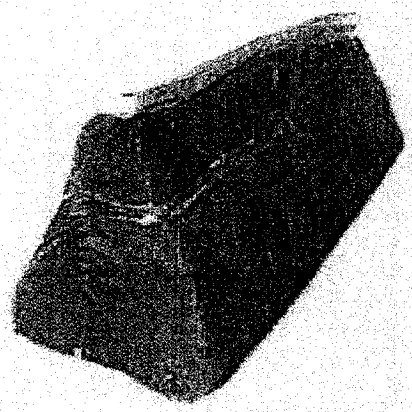
Cold Chain

CARBON MONOXIDE TREATED TUNA

Tuna is popularly eaten raw as sashimi. An important eating quality, freshness of the tuna, is indicated by the bright red colour of the raw meat. The desirable bright red colour is due to oxygenated muscle pigments.

Color of Tuna Meat

Myoglobin is the muscle pigment that serves to carry oxygen to the working muscles when the fish is alive. When the fish is cut up, oxygen comes into contact with myoglobin in the exposed tuna meat surface. The oxygen is absorbed and reacts with the myoglobin to form a bright red pigment (*oxymyoygobin*) which brings about the attractive red colour of fresh tuna meat (see picture 1). However, with storage over a period of time and continued exposure to oxygen, the red colour of the meat gradually changes into various shades of brown due to oxidation and conversion of the oxymyoglobin to a brown pigment (*metmyoglobin*)



Picture 1 : Normal red colour of a skin-on fresh tuna loin.

Carbon Monoxide Treatment

Recently, carbon monoxide (CO) gas has been used to treat tuna meat in order to retain its 'fresh' red colour for a longer period of time or to convert the brown colour to the desirable red colour. The carbon monoxide reacts with the muscle pigments to form a very stable complex, carboxymyoglobin. Fresh, chilled or thawed out frozen tuna cuts can be treated with CO to obtain the desired colour effect on appearance. This is a malpractice and is not condoned by Agri-food and Veterinary Authority (**AVA**) as CO-treated tuna meat could mislead consumers into thinking that it is fresher or of higher value than it actually is. The cherry red colour induced in CO-treated tuna is however abnormal or artificial looking (see picture 2).

Picture 2 : Cherry red colour of vacuum packed CO-treated tuna loin steak.

A collection of photographic images of normal coloured tuna loins may be viewed at the web site of the Center for Food Safety and Applied Nutrition, U.S. Food and Drug Administration under the heading of RFE (Regulatory Fish Encyclopedia) at the following address http://www.cfsan.fda.gov/~frf/rfeo.html

Tasteless smoke process

Tasteless smoke process is an approved processing technique whereby smoke generated as in a normal food smoking process is first filtered to remove the characteristic smoke flavour before application. This process is allowed to be used in the preservation of tuna. Such products are required to be clearly labelled as smoked so that consumers will know that it has been preserved by smoking.

Health Implications

There are no direct health implications from eating CO-treated tuna. However, CO treatment makes tuna appear to be fresh. Tuna which is becoming stale or spoiled will be accompanied by changes in texture, odour, and development of histamine apart from changes in colour. Consumers should not depend solely on the colour but pay more attention to other features to determine the freshness of tuna meat . **AVA** does not allow imports of CO-treated tuna and has intensified checks on all imports of chilled and frozen tuna cuts to stop CO-treated tuna from entry into Singapore. **AVA** also checks on local fish processing plants to prevent such malpractice. Consumers are nevertheless advised to examine the product before purchase and be suspicious of any unnatural cherry-red colour in tuna cuts.

Food Safety Awareness Programme	Cold Chain	Foo
Oscar, our Food Safety Mascot	The Cold Chain System	Foo and
Food Safety is a Shared Responsibility	Warm, Chilled and Frozen Meat	Foo
Importance of Food Safety	Chilled Meat-Safer and Better	
Tips on Avoiding Cross-contamination in Food	Safe Handling of Refrigerated Meat	
Keeping Cooked Food Safe	A Guide To Home Storage of Fresh Meat and Poultry	
Keeping diary Products & Eggs Safe	Temperature and How it Affects Your Meat	
Keeping Fruits & Vegetables Safe	Carbon Monoxide Treated Tuna	

Keeping Meat Safe

Keeping SeaFood Safe

Reducing Risks from Food-borne Hazards

Tips on Choosing, Storing and Cleaning Fruits and Vegetables

FAQ on Fruits and Vegetables

Food Storage Chart

5 Keys to Safer Food