EIGA Safety Information

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Cryogenic Nitrogen in Molecular Cooking

What is Molecular Cooking?

Molecular cooking is a method used by both scientists and food professionals to help study the physical and chemical processes that occur while cooking. When food preparation is done at cryogenic temperatures, usually using liquid nitrogen (-196°C), it is often referred to as cryogenic or cryo cooking.

In recent years cryogenic cooking has evolved from a novel demonstration at trade fairs to a new and accepted way of food preparation in many restaurants.

There is a growing list of food preparations using liquid nitrogen, including

- Preparation of nitro-meringues.
- Making powdered ice using a spray gun.
- Coating soft products with thin layers of jelly by repeated quick freezing with nitrogen.
- Creating Ice-cream pearls from a fruit coulis.
- Preparing fresh ice sorbet at the dinner table.

Cryogenic cooking is described as being about challenging the taste buds with contrasting and unexpected taste and is increasingly seen as a technique that modern chefs use.

A serious accident involving cryogenic nitrogen and molecular cooking

The use of liquid nitrogen in molecular cooking at restaurants, exhibitions, trade fairs and other related events is growing and you can often watch food being prepared using the cryogenic temperatures. This is an event intended for spectators but often the safety measures taken are inadequate and fail to properly control the risks to both the chef and possible spectators.

The Safety Advisory Council of EIGA (SAC) has received a report of an accident in connection with molecular cooking that resulted in severe injuries to a trainee chef. SAC wants to inform potential users about the hazards of using cryogenic liquids at extreme subzero temperatures for cooking demonstrations and has therefore prepared this safety information sheet.

Accident summary

A trainee chef was unaware of liquid nitrogen hazards when filling a closed container without appropriate authorisation. When the trainee chef tried to open the container at his home, it ruptured. The trainee chef lost one of his hands and suffered severe injuries to the second one.

The container used by the injured person was not designed for storing liquid nitrogen. It had been closed using an unvented screwed cap and the liquid nitrogen was trapped. The temperature of the liquid nitrogen was -196 °C and the ambient air temperature was approximately 20 °C. Due to the heat transfer into the liquid nitrogen, it warmed up

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and raised the pressure inside the container. As the container had no safety device to relieve pressure it ruptured when the cook tried to open it.

How to prevent accidents?

Literature for cryogenic cooking often emphasises that they are very basic recipes that do not require special education or skills to prepare. However this is definitely not true for safe handling of liquid nitrogen.

The Safety Advisory Council wants to ensure that gas companies supplying liquid nitrogen for this application have informed their customers about the hazards when using liquids with subzero temperatures for food preparation.

When handling cryogenic gases a minimum number of precautions have to be followed:

- Read carefully and respect all safety information written in the safety data sheet
- In case of doubt or questions contact the gas company which delivered the cryogenic liquid.

- Risk of burns
  - Be aware of the subzero temperatures: Liquid nitrogen: - 196 °C;
  - Only use materials suitable for cryogenic temperatures, as some materials become brittle when very cold.
  - When handling or decanting liquid nitrogen, never allow skin to come into contact with the liquid or surfaces at this low temperature: it will cause severe cold burns:
    - Protect your skin (wear long sleeves, long trousers);
    - Wear gloves suitable to handle cryogenic liquid;
    - Be careful that liquid nitrogen does not spill into shoes.
  - Prevent liquid nitrogen splashing into the eyes as this can cause temporarily or permanent blindness
    - Wear safety glasses and face shield to protect your face and eyes.

- Risk of pressure
  - Never trap subzero liquid in closed spaces – as the liquid warms up, the pressure rises until the container is liable to rupture.

- Risk of asphyxiation
  - Be aware of the large volume of gas which will be generated by evaporating liquid –1 litre of liquid will evaporate to apprimately 700 litres of gas.
    - Ensure adequate ventilation to avoid oxygen deficiency, when decanting liquid nitrogen in to containers at ambient temperature and when dipping warm food or cookware into the liquid nitrogen.
    - Keep spectators at a reasonable distance determined as part of the risk assessment.
    - It is highly recommended to use a monitor to detect the oxygen deficiency to protect the personnel and the spectators.

Suppliers of liquid nitrogen for cryogenic cooking should have provided information and advised customers on appropriate equipment to handle cryogenic nitrogen properly and safely and made them aware of the potential hazards when using liquid nitrogen in cryo cooking.

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As well as providing safety information for safe storage and use of liquid nitrogen, suppliers should be able to advise on:

- Containers for storage of liquid nitrogen;
- Open topped container for handling of liquid nitrogen and temperature control;
- Face, eye and hand protection;
- Safe operating practice (e.g. oxygen monitoring, safety distances for spectators, etc.).

Never use liquid oxygen for cryogenic cooking!

Is your cooking place safe?

Wherever you are practising molecular cooking, carry out a hazard assessment of your workplace and the immediate surroundings:

- Is your cooking place clean and orderly?
- Is the liquid nitrogen container secured against falling?
- Are you wearing the appropriate personal protective equipment?
- Is the safety distance to the spectators sufficient?
- Are you aware of the first aid requirements?
- Do you know the emergency procedure?

EIGA document references:

- EIGA Doc. 136 Selection of personal protective equipment
- EIGA Safety Leaflet 01 Danger of asphyxiation

This SI does not refer to transportation, please see;

- EIGA Safety Leaflet 03 Safe transport of gases

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