



CARGO ADVICE

Urea bulk cargoes

Introduction

Urea is a manufactured chemical that contains the elements carbon, oxygen, hydrogen, and nitrogen. The IMSBC Code describes urea as Group C.

Most urea is used as a nitrogen fertiliser, but a smaller amount is used by industry for the manufacture of plastics such as urea-formaldehyde resin. This grade requires a higher standard of cleanliness than fertiliser grade, as impurities can have a catastrophic effect on resin manufacture.

Chemistry

On the commercial scale, urea is made by reacting ammonia and carbon dioxide. The reaction produces urea and water. This water needs to be removed by evaporation.

On a smaller scale every human body makes urea, but only around 20g per day. You would need around five hundred million people to match the output of a large urea plant.

Urea is a hygroscopic cargo i.e it absorbs moisture from the air. It will cake if wet and may cake in overhangs.

Physical Form

There are two physical forms of urea that are commonly traded – prills and granules. Both are white. The former generally consists of smaller particles (around 2mm) which are rather weaker than the larger granules (3-4mm). The latter demands a premium. Prills look more rounded and shinier than granules. Both grades are used for fertiliser and industrial purposes.

Both forms of urea have a larger stowage factor (the ratio of weight to stowage space required under normal conditions) than most fertilisers and the Code cites a range of 1.17 to 1.56 m³ per tonne.

Pure urea would contain 46.67% nitrogen (the rest is carbon, oxygen and hydrogen). However, urea will never be completely pure. There will always be a little water and some 'biuret' (a similar chemical) left from the manufacturing process.

As noted above, urea can cake, and an entire hold can become a single lump. Some manufacturers add special chemicals (anticaking agents) to reduce the caking propensity.

Carriage of urea

Urea can generally be carried without any issues. However, the most common problems encountered are:

- Wetting from rainwater and seawater
- Contamination from previous cargo etc.
- Caking
- Failure to recognise increased requirements for industrial urea

Prior to loading

A specification will have been agreed between the various parties. If no specification has been provided to the vessel, then it should be requested. If a specification is not provided, then this should be recorded.

Typically, the nitrogen content of urea would be declared as 'over 46%'. Biuret and water would each have a maximum value (typically they would be specified to be below 1%).

As urea is usually pure white any coloured contamination will be very obvious. It is therefore particularly important to remove any traces of previous cargo especially grain or sulphur. Only a few grains of sweetcorn or a few granules of sulphur have given rise to customer complaints. Normal inspection of the holds should pick up such problems. Small quantities of contamination are relatively unimportant for fertiliser use but industrial customers need to have urea without contamination.

For example, a complete cargo of fertiliser was rejected by the Australian authorities because there were a few grains of wheat in it that had fallen from the hatch covers during the voyage. The argument being that wheat could potentially contain fungi. Thousands of tonnes of fertiliser subsequently toured the Pacific to find a new home some months later.

The term 'free flowing' may be included in the specification. Beware this has no technical or proven commercial definition. It may be interpreted (by the supplier) as free flowing at the load port (no lumps were visible during loading) or interpreted (by the receiver) as not free flowing at the discharge port (the urea had caked into a single coherent mass during the voyage). These are very different: if the urea cakes in transit, then who is to blame? In order to determine the root cause it is essential that good quality sampling is performed in order that experts can assess the problem(s).

In summary, prior to loading:

- All holds must be clean and dry
- Particular attention should be paid to cleaning if grain and sulphur have been carried recently

- Make sure there are no possible water leaks from pipes or bilges
- Read the Code and follow the given precautions

During loading

The Code advises that the cargo should not be handled during precipitation and that all non-working hatches of the cargo spaces into which this cargo is loaded or to be loaded shall be closed. This is sound advice.

- Monitor the physical quality and advise the relevant personnel if lumps and/or dust are observed: a little of each is not unusual. If in doubt refer to the specification or ask an expert.
- Samples should ideally be taken during loading. The sampling procedure should follow local or international standards and should be documented with a Sampling Report.
- Do not load during precipitation. Some load ports may require that loading is suspended if there is high relative humidity in the air. Local procedures should be followed: it is not possible for precise limits to be set.
- Check loading equipment for cleanliness prior to use. Do not load contaminated spillage and dispose of contaminated urea safely in line with local regulations.
- Trim in accordance with the relevant provisions required under Sections 4 and 5 of the Code.

Regarding rainfall, it is prudent to observe any available radar or even to simply appoint a dedicated crew member to watch out for any imminent rain and cease loading before the rain hits the urea. Do NOT load during rainfall.

Urea will normally be close to atmospheric temperature during loading. If it is slightly warm it will not absorb water from humid air to the same extent. However, if the urea is hot, for example 40°C or greater, it will exhibit a greater caking tendency during the voyage.

After loading

- Close and seal the hatches
- Close the vents before sailing

If you are given a portion of the sample from the sampler, then preserve it for possible future analysis. Store it in a cool dry place away from heat and out of direct sunlight.

During the voyage

Do not ventilate the holds. Urea will absorb water from moisture in the atmosphere.

During discharge

Water

- As soon as the hatches are opened check the top surface to see if there has been any water leakage through the hatches and, if this has taken place, then segregate the wetted urea.
- As discharge proceeds, continue monitoring the urea for signs of water ingress. If observed, then again segregate any wetted urea. Urea that has been damaged by water will still retain its nutrients but cannot be spread by farmers in the normal way.
- Watch out for rain in the same manner as during loading. In case of rain, discharging should be suspended, and all hatches must be closed.

Caking

If the urea becomes lumpy as discharge proceeds with uniform lumps becoming harder at greater depth, then this is caused by 'caking'. Caking is caused by a combination of many factors but is NOT caused by any fault of the vessel. Caking of urea can easily be distinguished from lumps caused by water-ingress by an expert when provided with a suitable photographic record. Caking is NOT associated with water ingress. It is strongly recommended that there are suitable photographs taken and that expert advice is sought as soon as possible.

Even without any contact with water (precipitation or humid air) urea can cake into 'cliff faces'. If the cliff face is broken up at the base of the cliff, then overhangs can form. These can potentially fall and injure personnel.

Some caking is quite normal but if the caking requires extra effort to recover the urea from the hold(s) during discharge, the receiver may complain that the vessel has caused the caking.

If the caking is uniform across the stow then it is more likely to be caused by an inherent vice in the urea, perhaps an inadequate anticaking regime. Some light caking may be acceptable to the receivers (depending upon their own standards which would not be known to the crew). The crew should inform all interested parties of the nature of the caking that can be observed. In order to assess the potential liability, it is important to document the evidence with photographs, statements etc. It is worth noting that the location of the photographs should be identified (for example port side aft of Hold 1 etc).

As noted above, wetted urea retains its nutrient value. However, if the wetting is caused by salt water it should be noted that some crops are sensitive to chloride (salt). Wetted urea is more difficult to handle and compensation is inevitable. The amount of compensation is difficult to quantify as it depends upon the local situation – for example if agriculture is highly mechanised.

After discharge

The cargo spaces can be swept clean. Urea is totally soluble in water; therefore, any residual traces can be washed clean and dried. Dispose of any washing responsibly in accordance with local regulations.



- Remove any traces of previous cargo especially grain or sulphur.
- Samples should ideally be taken during loading. The sampling procedure should follow local or international standards and should be documented with a Sampling Report. Preserve the sample for possible future analysis. Store it in a cool dry place away from heat and out of direct sunlight.
- Do not load during rain.
- Do not ventilate the holds. Urea will absorb water from moisture in the atmosphere.
- Some light caking may be acceptable to the receivers. The crew should inform all interested parties of the nature of the caking that can be observed.

The Swedish Club: Cargo Advice - Urea

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