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Danger on board?

Say “dangerous goods” and most people think of heavy goods vehicles or tankers with warning signs. But everyday products in transport can also pose a danger.

Egypt, 23 March 2021, 07.40 am local time: in the Suez Canal, the 400-metre-long container ship Ever Given runs aground right across the canal and blocks the sea route. 12 percent of the world’s maritime trade is paralysed. The world’s media runs constant articles on the incident, and it soon becomes clear: it could have been worse. Fortunately, the securing and stowage of the goods on the ship, which had been stuck for almost a week, were done properly.

Every day, millions upon millions of transport containers carrying a huge range of freight are moved around the world on giants of the sea like the Ever Given, as well as on goods trains and trucks. The range of products is as varied as the choice of goods on offer in world trade – from plastic bath animals to lawn fertiliser granules, every imaginable product is on board. The challenge of it: many goods harbour unexpected potential dangers on the often long journey to international retail shelves if they are not transported correctly. Science is on board here, because the potential hazards are chemical, biological and physical in nature.

Hole-forming fruit juice

Carrying goods on their way to end consumers requires not just product and food safety, transport safety is also essential, and therefore the expertise of the German Federal Institute for Risk Assessment (BfR). Dr. Renate Krätke and her team deal with issues around the transport of dangerous goods within the BfR. In this field, which is monitored by several national and international authorities, comprehensive regulations govern a wide range of safety aspects during transport by road, rail, waterways and sea, including how cargo must be packed and positioned on a ship, for example. This is particularly important for liquid or solid mass goods that are transported unpackaged as loose 'bulk goods' in tankers or bulk carriers (also known as bulkers).

"For example, the citric acid in fruit juice can corrode metal containers," explains biologist and toxicologist Krätke. The same is true of vinegar, which has an acid content of over ten per cent, and undiluted cola syrup containing phosphoric acid. "If goods such as these are transported on ships for sometimes weeks at a time, and are not properly packed and stowed, there is an impact on the goods and on the containers," says Krätke. "For example, we are working on stipulating conditions of carriage that guarantee that acidic liquids are carried in non-corroding transport tanks."



Risky spirits

The transport risks when it comes to alcoholic beverages seem perfectly apparent at first glance: the higher percentage of the drink, or the more ethanol it contains, the riskier its carriage becomes. The most important factors are the flash point temperatures (meaning the temperature at which flames will form on contact with an ignition source) and the boiling range (when there is a change from a liquid to a gaseous state). This results in strict specifications for the classification of dangerous goods. In practice, this means that spirits need to be stowed differently than beer, for example, which contains less alcohol and which means transport problems only at considerably higher temperatures.

Anti-sliding rules

Some materials could easily slide during transport movements, shift their containers, and thus affect stability in the cargo area. There are 'angle of repose' rules for these loose goods, which determine how steeply and high they may be stacked. Such goods can include foodstuffs or animal feed, such as tapioca starch in powder form, or as pellets (tapioca pearls). The rules help to ensure that cargo does not move about on the mode of transport, and ships, trains and trucks do not become dangerously unbalanced.





Gradual self-heating

Additional regulations stipulate that foodstuffs and animal feed may not be stored next to goods such as crude oil and chemicals. That not only protects the foodstuff, it also protects the entire transport vehicle and the crew, according to Dr. Enikő Kámory. “Even supposedly harmless foodstuffs can harbour a risk in the wrong transport conditions,” explains the BfR scientist. For example, if solid foods that contain fat and oil are stored incorrectly and absorb moisture from the environment, natural degradation processes can cause the material itself to heat up. This occurs slowly at first, but can intensify over time and lead to spontaneous combustion. If a fire spreads in the container, neighbouring cargoes, such as chemicals, are no longer safe.

Exploding flour

Another example of the consequences that can result in extreme cases, in this case from incorrect storage, but also in principle from incorrect transport, is the destruction of a flour mill in Bremen – one of the most serious explosions in Germany since the end of the Second World War. In 1979, 14 people lost their lives in the accident and the physical damage ran to 100 million German Marks. The trigger was flour – or to be precise, a dust explosion caused by flour. The smaller the dust particles, the more susceptible they are to an explosion when they come into contact with an ignition source. A similar scenario could develop at any time during the transport of the everyday consumables we enjoy such as sugar, spices, coffee and cocoa if the rules prescribed for the transport of these goods are not adhered to, because these goods often make long journeys in containers.

The science-based transport regulations were evidently observed on the Ever Given. Thus, despite the extended waiting time, the goods were unloaded accident-free at their destination four months after the freighter had been freed. It goes to show that scientifically and empirically proven transport regulations are effective in reality. ■

