Kirk-Othmer Encyclopedia of Chemical Technology.

ACETAMIDE

Acetamide [60-35-5], C_2H_5NO, mol wt 59.07, is a white, odorless, hygroscopic solid derived from acetic acid and ammonia. The stable crystalline habit is trigonal; the metastable is orthorhombic. The melt is a solvent for organic substances; it is used in electrochemistry and organic synthesis. Pure acetamide has a bitter taste. Unknown impurities, possibly derived from acetonitrile, cause its mousy odor (1). It is found in coal mine waste dumps (2).

1. Physical and Chemical Properties

Table 1 lists many of acetamide's important physical properties. Acetamide, CH_3CONH_2, dissolves easily in water, exhibiting amphoteric behavior. It is slow to hydrolyze unless an acid or base is present. The autodissociation constant is $\sim 3.2 \times 10^{-11}$ at 94°C. It combines with acids, eg, HBr, HCl, HNO_3, to form solid complexes. The chemistry of metal salts in acetamide melts has been researched with a view to developing electroplating methods. The literature of acetamide melts and complexes, their electrochemistry and spectroscopy, has been critically reviewed (9).

2. Manufacture

Most commercial routes for the production of acetamide involve dehydration of ammonium acetate [631-31-8]:

$$NH_4OOCCH_3 \longrightarrow H_2O + CH_3CONH_2$$

Industrial production is often based on transformation of this laboratory method into a continuous process (10). Another route is acetonitrile [75-05-8] hydration:

$$CH_3CN + H_2O \longrightarrow CH_3CONH_2$$

Because huge quantities of by-product acetonitrile are generated by ammoxidation of propylene, the nitrile may be a low cost raw material for acetamide production. Copper-catalyzed hydration gives conversions up to 83% (11), and certain bacteria can effect the same reaction at near room temperature (12).

3. Shipment

It is shipped in 32-L (35-gal) drums weighing about 80 kg.

Table 1. Physical Properties of Acetamide

Property	Value	Reference
melting point (trigonal), °C	80.0–80.1	3
triple point, K	353.33	4
heat of melting, ΔH_m, kJ/kg[a]	264	5
dielectric constant	59	6
dipole moment, C·m[b]	12.41×10^{-30}	3
density equxation[c]	$1.357 - 0.0012T + 0.64 \times 10^{-6}T^2$	6
melt density at 85°C, g/mL	0.9986	7
vapor pressure at T in K, kPa[d]		8
272	10	
278	20	
281	30	
284	40	
285	50	
287	60	
288	70	
290	80	
291	90	
292	100	

[a]To convert kJ to kcal, divide by 4.184.
[b]To convert $\mathrm{C{\cdot}m}$ to debyes, multiply by 2.998×10^{29}.
[c]Kelvin temperature.
[d]To convert kPa to mm Hg, multiply by 7.50.

4. Health and Safety Aspects

Acetamide has been used experimentally as a source of nonprotein nitrogen for sheep and dairy cattle (13). It does not appear to be toxic in amounts of ∼2–3% of ration. Buffering the diet with dibasic acids serves to allow higher levels of intake because the ammonia liberated in the digestive process is then scavenged. International Agency for Research on Cancer (IARC) has reported acetamide as a possible carcinogen to humans (14).

5. Uses

Acetamide appears to have a wide spectrum of applications. It suppresses acid buildup in printing inks, lacquers, explosives, and perfumes. It is a mild moisturizer and is used as a softener for leather, textiles, paper, and certain plastics. It finds some applications in the synthesis of pharmaceuticals, pesticides, and antioxidants for plastics. Acetamide and substituted acetamide-containing thiourea can be used for treatment of herpes viruses (15). Derivatives can also be used as feeding behavior modifiers (16)

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