

Crack CSIR-NET 2021

(Study Notes on DMF)



Dimethylformamide (DMF)

Introduction:

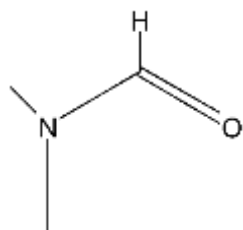
Dimethylformamide is an organic compound having formula $(\text{CH}_3)_2\text{NC}(\text{O})\text{H}$. It is generally abbreviated as DMF. It is a colourless liquid which is miscible in water and in other organic solvents. It is considered as a common solvent for chemical reactions. It is a derivative of formamide – an amide of formic acid. It is a polar aprotic solvent having a high boiling point. It helps in facilitation of $\text{S}_{\text{N}}2$ reaction. This solvent is preferred to produce acrylic fibres.

Production:

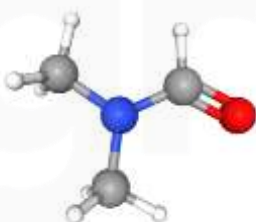
It is prepared by combining methyl formate with dimethylamine or by reaction of dimethylamine with carbon monoxide. It can also be prepared by using supercritical carbon monoxide in the presence of a Ru based catalyst. It was firstly prepared by French chemist. In this method, distillation of a mixture of dimethylamine hydrochloride and potassium formate has been carried out.

Structure:

Its 2-D structure is:



In 3-D structure, it can be represented as:



Properties:

According to spectroscopic experiments, for most amides, partial double bond character has been indicated for C-N and C-O bonds. IR spectrum shows C=O stretching at 1675 cm^{-1} while ketone absorbs at 1700 cm^{-1} . It is the best example of a fluxional molecule. Some its properties are depicted in the table given below:

Melting point:	-61 °C (lit.)
alpha	0.94°
Boiling point:	153 °C (lit.)
Density	0.944 g/mL (lit.)
Vapor density	2.5 (vs air)
Vapor pressure	2.7 mm Hg (20 °C)
storage temp.	Store at RT.
Solubility	Water : miscible
form	Powder
Colour	ALPHA : ≤ 15
PH	7 (200g/l, H ₂ O, 20°C)
Water Solubility	Soluble
Sensitive	Hygroscopic

Reactions of DMF:

It gets hydrolysed in the presence of strong acids and bases at elevated temperatures. In reaction with NaOH, it gets converted to formate and dimethylamine. It undergoes decarbonylation near its boiling point that results in the formation of dimethylamine. It is a main reagent in the Vilsmeier-Haack reaction which is used in the formylation of aromatic compounds. It is also used in Bouveault reaction in which Grignard reagent react with DMF to give aldehydes.

Uses:

- Pharmaceutical processing
- Agriculture
- Polymer processing
- Refining
- Textile
- Fibres

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