AJEMA GLOBAL RESEARCH NETWORK

AMERICAN Journal of Engineering, Mechanics and Architecture
Volume 2, Issue 12, 2024 ISSN (E): 2993-2637

Structure and Properties of Chemical Transformations of Aromatic Dicarboxylic Acids

Mamatqoriyev Otabek Vahobjonovich
Master's student at Termez State University

Kungiratov Inom Nazarullayevich
Master's student at Termez State University

Abstract: Aromatic dicarboxylic acids are aromatic compounds with two carboxyl groups, often located on a benzene ring. Their properties and transformations are unique, and their complete correction and reactions are discussed.

Keywords: Aromatic dicarboxylic acids, correction, phthalic acid, electrophilic, substitution, isophthalic acid.

INTRODUCTION

Aromatic dicarboxylic acids are usually formed by the attachment of two carboxyl (COOH) groups to a benzene ring. The most famous examples are:

1. Phthalic acid (benzene-1,2-dicarboxylic acid): An acid consisting of two carboxyl groups located in the middle of the benzene ring.

- Structure: $C_6H_4(COOH)_2$
- Reactions: Usually participates in electrophilic substitution reactions, meaning that new groups can be added to the benzene ring.

2. Terephthalic acid (benzene-1,4-dicarboxylic acid): Has two carboxyl groups at opposite positions on the benzene ring.

- Structure: C6H4(COOH)2 (in this case, the groups are at the 1,4 positions)
- Reactions: Still undergoes electrophilic substitution reactions, but can sometimes react more violently.

3. Isophthalic acid (benzene-1,3-dicarboxylic acid): Carboxyl groups located at the 1,3 positions on the benzene ring.

- Structure: C6H4(COOH)2 (in this case, the groups are located at positions 1,3)
- Reactions: Again prone to electrophilic substitution reactions, but differences in ring positions can affect the properties of the reaction.

LITERATURE ANALYSIS AND METHODOLOGY

Aromatic dicarboxylic acids can participate in many different reactions. These include:

1. Electrophilic substitution reactions:

- Various groups (e.g., nitro, sulfate, alkyl) can be added to replace the hydrogen atom in the benzene ring.

2. Decarboxylation (removal of the carboxyl group):

- If the second carboxyl group of a dicarboxylic acid is removed, the resulting compound is converted into an aromatic hydrocarbon (benzene). These reactions occur at high temperatures and in the presence of certain catalysts.

3. Esterification reactions:

- Aromatic dicarboxylic acids can react with aliphatic or aromatic alcohols to form esters in the esterification process. This reaction is mainly carried out using acid catalysts.

4. Aminolysis:

- Reactions with substituted amines to form amino acids or amides.

5. Polymerization:

- Aromatic dicarboxylic acids can undergo polymerization reactions at high temperatures to form high molecular weight polymers (e.g., polyethylene terephthalate).

Properties:

1. Acidity:

- Aromatic dicarboxylic acids have high acidity. Their pKa values are in the range of 3-5, which allows them to be classified as strong acids.

2. Water solubility:

- They are highly soluble in water due to their polar properties, since the acidic nature of the carboxyl group leads to their hydration.

3. Hardness and miscibility:

- Some aromatic dicarboxylic acids, such as terephthalic acid, are prone to high hardness and crystallization.

4. Ability to form aromatic salts:

- These acids can often exist in the form of salts, such as sodium or potassium salts.

RESULTS. Aromatic dicarboxylic acids and their chemical properties can be described in tabular form as follows:

1. Chemical properties of aromatic dicarboxylic acids.

Special	Phthalic acid	Terephthalic acid	Isophthalic acid
Acidity (pKa)	3.4 (first COOH), 4.3 (second COOH)	4.5 (first COOH), 5.5 (second COOH)	3.6 (first COOH), 4.9 (second COOH)
Water solubility	Good (hydrated with carboxyl groups)	Good	Good
Electronic conductivity	Moderate (due to the influence of the benzene ring and carboxyl groups)	Good (stabilization of the para-position)	Good (uniqueness of meta-position)
Hardness	Hard, prone to crystallization	Good crystallization	Good crystallization

2. Chemical changes and reactions.

Reaction type	Phthalic acid	Terephthalic acid	Isophthalic acid
Electrophilic substitution	Good (ortho and para location)	Good (groups in para positions interact)	Average (meta location impact)
Esterification reactions	Easy esterification, requires high temperature	Easy esterification, fast results	Easy esterification, fast results
Decarboxylation	Easy (CO_2 release)	Easy (CO_2 release)	Easy (CO_2 release)
Polymerization	Less (only in special circumstances)	Widely used (e.g. in PET production)	Less (but possible)

3. The importance of aromatic dicarboxylic acids in industry

Industry	Phthalic acid	Terephthalic acid	Isophthalic acid
Polymer production	Less commonly used	PET (polyethylene terephthalate) production	Less commonly used
Medications	Used in medicine	Good efficient synthetic reactions	Sometimes used
Production of esters	Well used	Well used	Well used

CONCLUSION

Aromatic dicarboxylic acids are of great importance in industry, and their main areas of application are widely used in the production of polymers, paints, pharmaceuticals, polyamides, rubber, and high-tech products. The chemical structure and properties of these acids allow them to be effectively used in various industries.

LIST OF REFERENCES

1. H. M. Shohidoyatov H. O'. Xo'janiyozov H. S. Tojimuhamedov, ”Organik kimyo” TOSHKENT – 2014 118-b.
2. A. Abdusamatov, R. Mirzayev, R. Ziyayev “Organik kimyo”. Toshkent «O‘qituvchi» 2004 y.126-135b.
3. О. Я. Нейланд Органическая химия. М.: «Школа Вишши». 1990. Б.563-582.
4. Yoqubovich M. S., Amonovich T. M. regional focus and tautomericity in the series of aroylhydrasones of β-dicarbonyl compounds //Journal of Pharmaceutical Negative Results. – 2022. – С. 279-287.
5. Дж. Робертс, М. Казерио. Основная органическая химия. М.: «Мир». 1978. ТС 565-575.
6. S. Masharipov, L.Tirkashev ,”Kimyo” Toshkent – 2007 y 245-252 b.
7. Юнусов Р.Ю.Органик кимё. Т.: Ўзбекистон, 1995. -328 б.
8. Степаненко Б. Н. Органик химия Т.Ўқитувчи, 1995.-370 б.
9. Юсупов Д., Туробжонов С.М., Кодиров Х.Э., Икромов А., Каримов А.У. Органик кимёнинг бошлангич асослари. Тошкент, 2006. -290 б.
10. Alovitdinov A.B., Ismatullaeva M.G., Xolmuradov N.A. Organik kimyo, T.; O’qituvchi, NMIU, 2005.-416 б.