

Synthesis of precursor of di-carbazolyl pentane

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Abstract: The synthesis of 2,4 pentanediol is successfully achieved . It will act as a precursor for the synthesis of 2,4 dicarbazolyl pentane to be a model compounds of poly-vinyl carbazole act as conducting organic polymer. IR of the performed reaction has been recorded and it shows that the reaction has achieved success.

Keywords: acetylacetone, sodium borohydride, methanol, reaction condition, molar ratio

Introduction: The world energy consumption data till 2018 released by BP [1]. It has been estimated that upto 2050 the world population will cross 9.8 billion [2] and the electricity share is overall energy need for such huge amount of population, can't be fulfilled by the continuous use of natural resources. We have to think in entirely new direction and find more innovative way to overcome this situation. We have to develop clean and renewable energy sources and have to make them cost effective, for the matter of fact the steps are already taken and many big companies in the market like Sun Power Corp. etc. are already on the track of processing and developing such technology which is helpful in providing efficient clean and renewable energy out of which photovoltaic is the emerging field.

Looking at the future energy demand, now many developing countries are investing in the research and development of trailblazing technology of photovoltaics. The main advantage of photovoltaic include that it converts sunlight into energy without using movable devices [3]. Radiation coming from sun reaches in the form of photons which are basically the packets of energy. These photons energy depends on which part of spectrum they are coming from and accordingly they have distinct wavelength. They interact with PV cells. The photons which gets absorbed produces current, while the energy of the photons is passed on the electron. These excited electrons leaves it's previously occupied space and hence became the part of the current in electric current. The photovoltaics concept was developed in 1839 by Edmond Becquerel [4]. Organic PV designs are constructed by keeping in mind of excitonic character which is the key feature of such PV [5]. Organic semiconductors are of two types: [6]

1. Small molecule-based semiconductors 2. Polymer-based organic semiconductors. Carbazole based conducting polymers are using now a days in the lab for the development of organic photovoltaics [7].

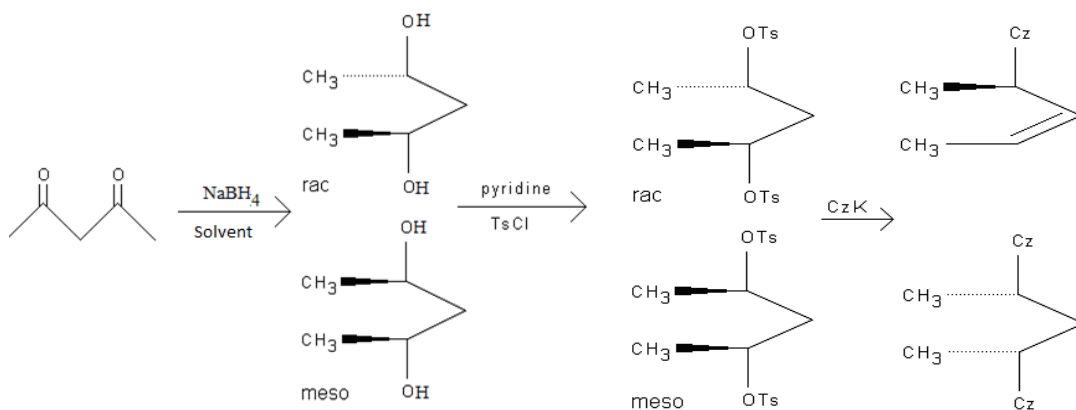
Experimental Section:

Fig. 1: Possible route for the synthesis of 2, 4 di(*N*-carbazolyl)pentane

The synthesis for 2, 4 pentanediol has been performed from acetylacetone and sodium borohydride in the presence of methanol at below 0°C. In one condition: the molar ratio of acetylacetone: NaBH₄ = 1:0.50 and the reaction set in methanol (10 ml). The reaction ran for 5.0 hrs. at temperature below 0°C. The reaction mixture has been worked up with 30 ml DCM and 3 ml H₂O. The organic solvent was evaporated under vacuum in rotavapor. Fig 2 demonstrates the IR for the confirmation of the product.

In another condition: the molar ratio of acetylacetone: NaBH₄ = 1:0.75 and the reaction set in methanol (10 ml). The reaction ran for 8.0-9.0 hrs. at temperature below 5°C. The reaction mixture has been worked up with 50 ml DCM and 10 ml H₂O. The organic solvent was evaporated under vacuum in rotavapor. Fig 3 demonstrates the IR for the confirmation of the product.

Result and Discussion: The Shimadzu FTIR has been used to record IR for the compound performed in reaction 1. No carbonyl signal is present (~1700 cm⁻¹) in both IR. Hydroxyl signal is present in both IR (~3300 cm⁻¹). It is a broad H-bonded and C-O stretching vibration signal present at (~1100 cm⁻¹). Sodium borohydride was used from new unopened pack.

Conclusion: This study has explained that the reduction of carbonyl group was successful performed under methanol as a solvent and the molar ratio between acetylacetone : NaBH₄ = 1: 0.75, the yield of reduced product was very well under the aforementioned condition.

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References:

1. G. Jones and L. Bouamane, "Power from Sunshine": A Business History of Solar Energy, Harvard Business School Working Paper, No. 12–105, 2012.
2. B. Kippelen and J.-L. Brédas. "Organic photovoltaics." *Energy & Environmental Science* 2.3, 251-261, 2009.
3. M. A. Birhanu, "Fabrication and Characterization of Small Molecule Organic Solar Cells". MS thesis. Universitat Politècnica de Catalunya, 2013.
4. H. Higginbotham, K. Karon, P. Ledwon and P. Data, "Carbazoles in Optoelectronic Applications" *Display and Imaging*, 2, 207–216, 2017.

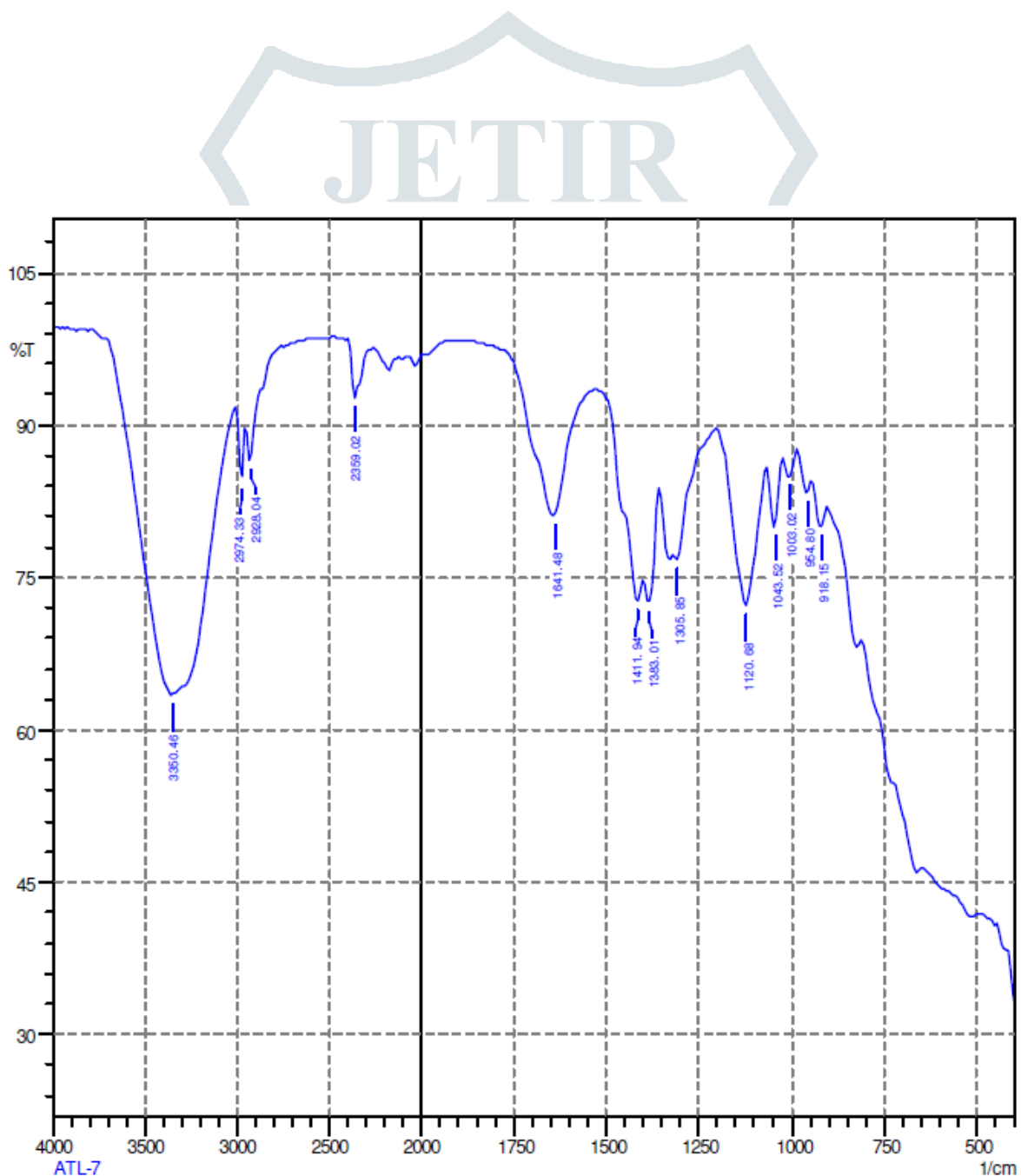


Fig. 2: acetylacetone (1) + NaBH₄ (0.5) + MeOH

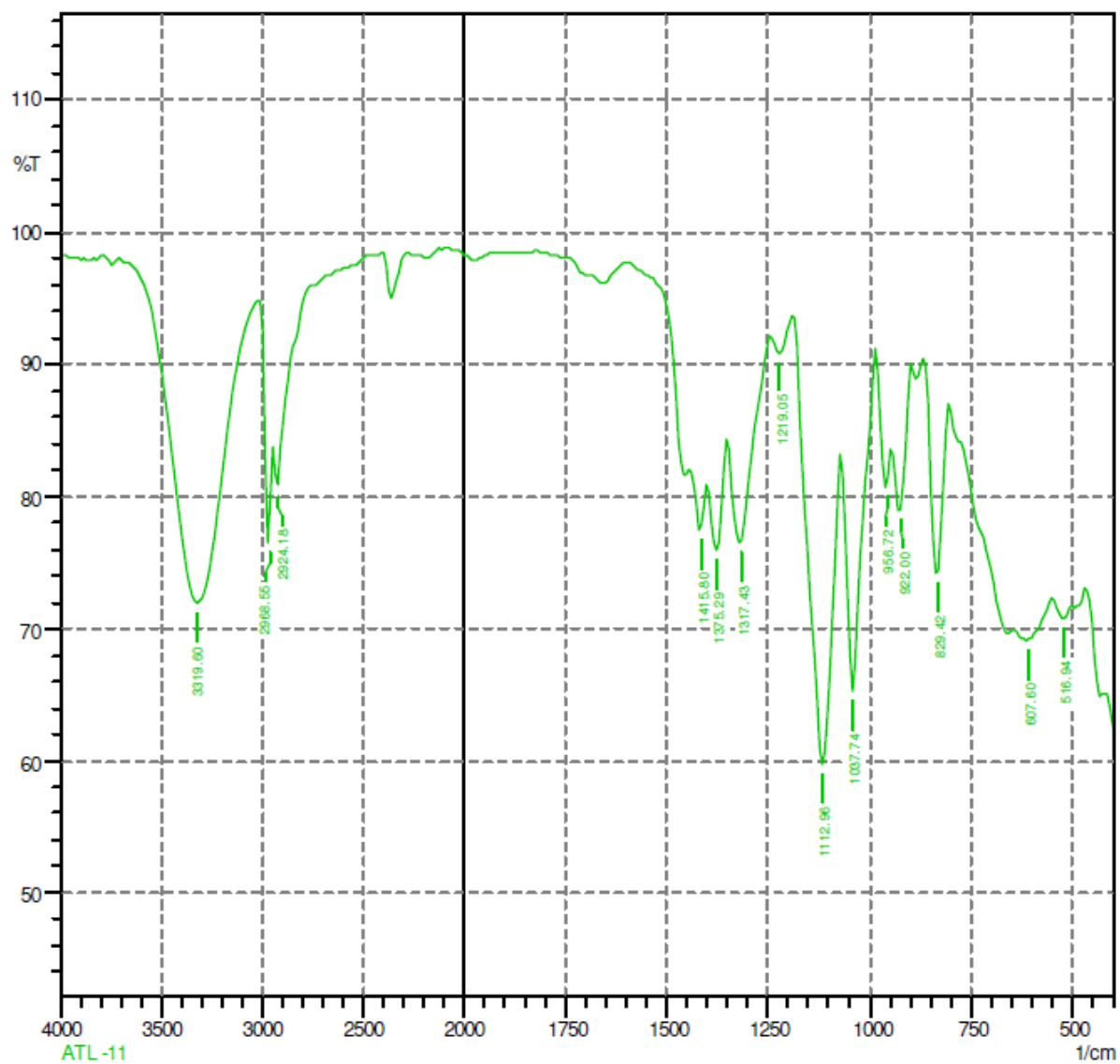


Fig. 3: acetylacetonate (1) + NaBH₄ (0.75) + MeOH