

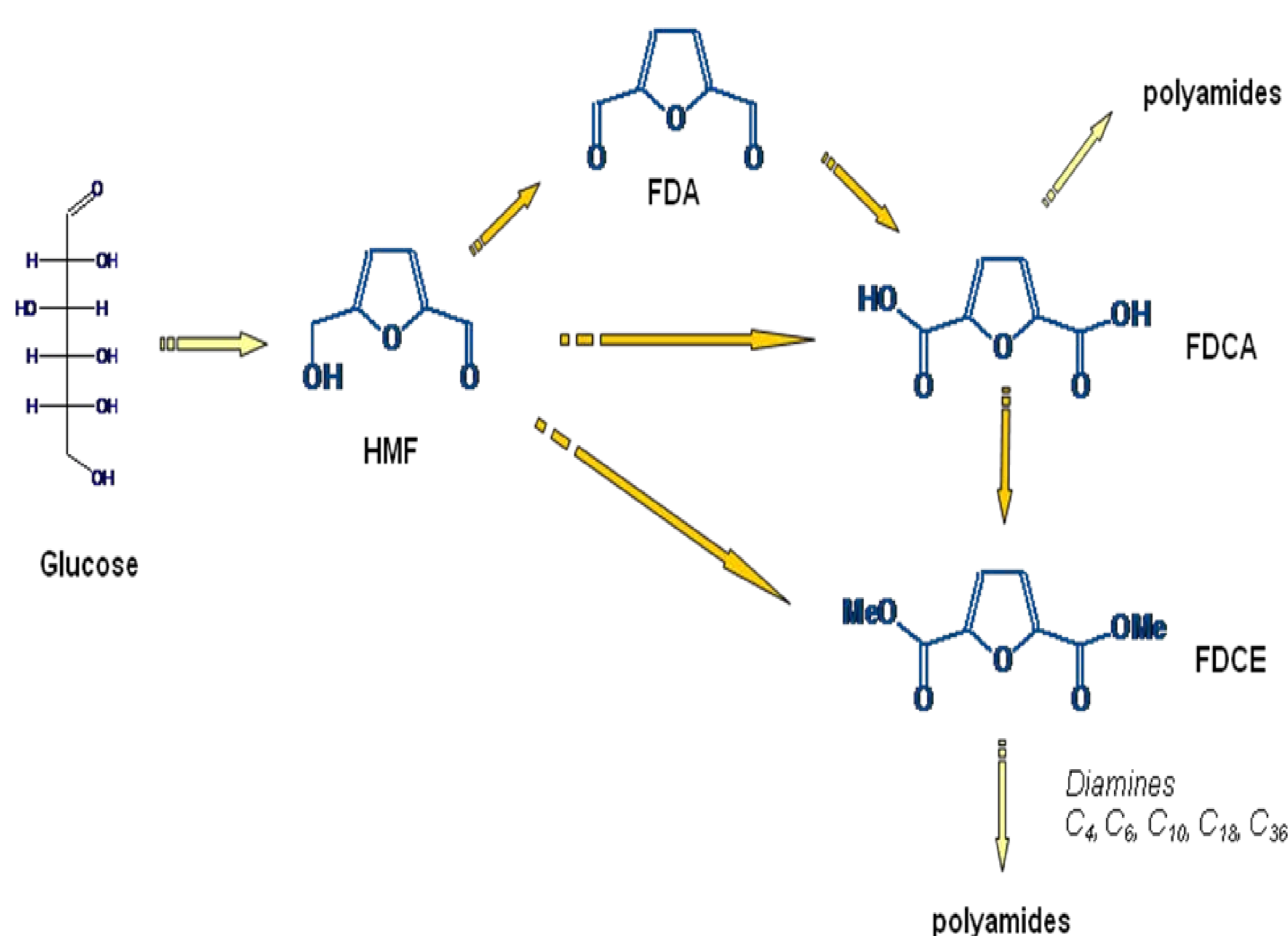
**POLYGLU** : an industrial research project coordinated by IRCELYON (*Institut de recherche sur la catalyse et l'environnement de Lyon*).

**Partners** : l'IMP-INSA-Lyon (*Ingénierie des matériaux polymères*) and Arkema.

**Objectives**: Production of polyamides using renewable resources.

**Methodology**: - Optimization of the monomers synthesis 2,5-furandicarboxylic acid (FDCA) derived from 5-hydroxymethyl furfural starting from glucose .  
-Synthesis, modelling and characterization of FDCA based polyamides

POLYGLU optimizes all the steps of the conversion from glucose to polyamides



FDCA synthesis via the Oxynitrox<sup>®</sup> technology

•Oxynitrox<sup>®</sup> (nitroxide mediated oxidation technology) is efficient for the **HMF oxidation into FDA** with bleach in a biphasic system. FDA has been isolated with **70% yield** and the Oxynitrox<sup>®</sup> catalyst can be recycled at least twice.

•The nitroxide technology is less efficient for the FDCA production. Isolated yields are below 30%. Other oxidation technologies targeting FDCE are under investigation.

Synthesis, modeling and characterization of FDCA based polyamides

•A molecular modeling protocol has been successfully developed for the study of amorphous polyamides: It correctly predicts the thermal behavior of synthesized model polyphthalamides based on terephthalic and isophthalic acid [5]

•This protocol was used to predict the properties of polyamides based on FDCA.

•These predictions have also been verified by the synthesis and characterization of FDCA and isophthalic based copolyamides in a high capacity pilot-scale reactor.

Patents and publications

[1] « Procédé d'isomérisation du glucose en fructose »

FR 1157575 Date de dépôt : 26 aout 2011

PCT/EP2012/066546, date de dépôt : 24 aout 2012

[2] "5-Hydroxymethylfurfural (5-HMF) production from hexoses: limits of heterogeneous catalysis in hydrothermal conditions and potential of concentrated aqueous organic acids as reactive solvent system".

R. Lopes de Souza, F. Rataboul, N. Essayem

Challenges 3 (2012) 212-232

[3] « Procédé de préparation de 5-hydroxymethylfurfural »

FR 11/54232 date de dépôt : 16 mai 2011

PCT/EP2012/059193, date de dépôt : 16 mai 2012

[4] "Glucose-fructose isomerisation promoted by basic hybrids catalysts"

R.L. Souza, D. F.Patrick, C.Feche, D. Cardoso, F. Rataboul, N. Essayem

Catal. Today, DOI: 10.1016/j.cattod.2012.05.046

[5] "Molecular modelling of polyphthalamides thermal properties: Comparison between modelling and experimental results" Cousin, T.; Galy, J. & Dupuy, J.

Polymer, (2012), 53, 3203 - 3210

## Main achievements

### 5-HMF synthesis from glucose

•We disclose in this project that **concentrated aqueous solutions of carboxylic acids used as reactive solvent system**, lead to the selective dehydration of fructose in 5-HMF with yields up to 64% .



•A novel process of 5-HMF preparation starting from glucose was patented: it involves a preliminary step of glucose isomerisation into fructose over weak solid bases [1,2] and a dehydration step using concentrated solutions of carboxylic acids as reactive solvents systems [3,4]

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