Seventh Conference of Young Chemists of Serbia

Microwave-Assisted of synthesis and characterizations of levulinic acid (LA)

Jovanka N. Kovačina[1], Jovan D. Kojić[2], Milena D. Milošević[3], Aleksandar D. Marinković[2]

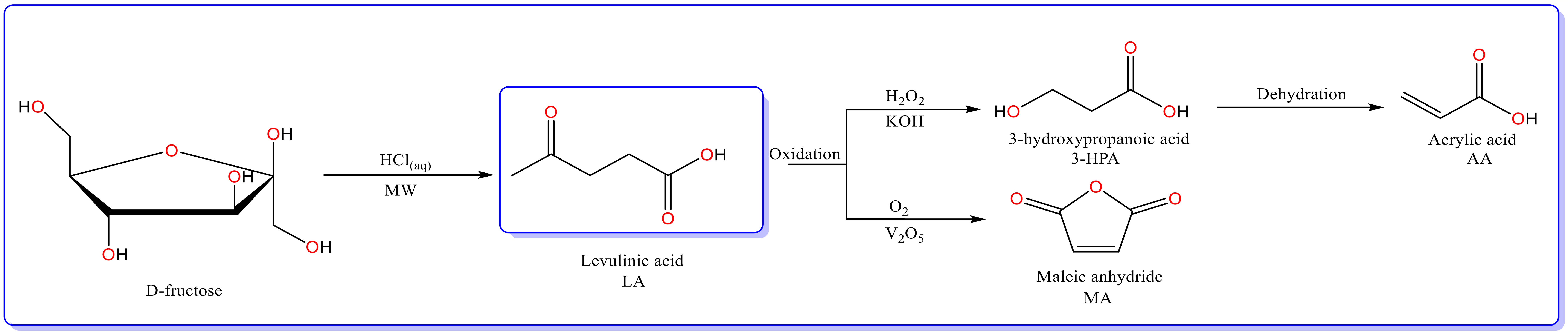
[1]*University of Belgrade, SI Institute of Chemistry, Technology and Metallurgy National Institute, Department of Electrochemistry, Belgrade, Serbia*
[2]*University of Belgrade, Faculty of Technology and Metallurgy, Belgrade, Serbia*
[3]*University of Belgrade, SI Institute of Chemistry, Technology and Metallurgy, National Institute, Department of Ecology and Technoeconomic, Belgrade, Serbia*

Introduction

Levulinic acid (4-oxopentanoic acid) (LA) is a two-functional γ-keto acid widely used in a production of pharmaceuticals, ethyl levulinate, the substance which is widely used in the cream and perfume industry, polymers, plasticizers, biofuel, resins, and various other additives.

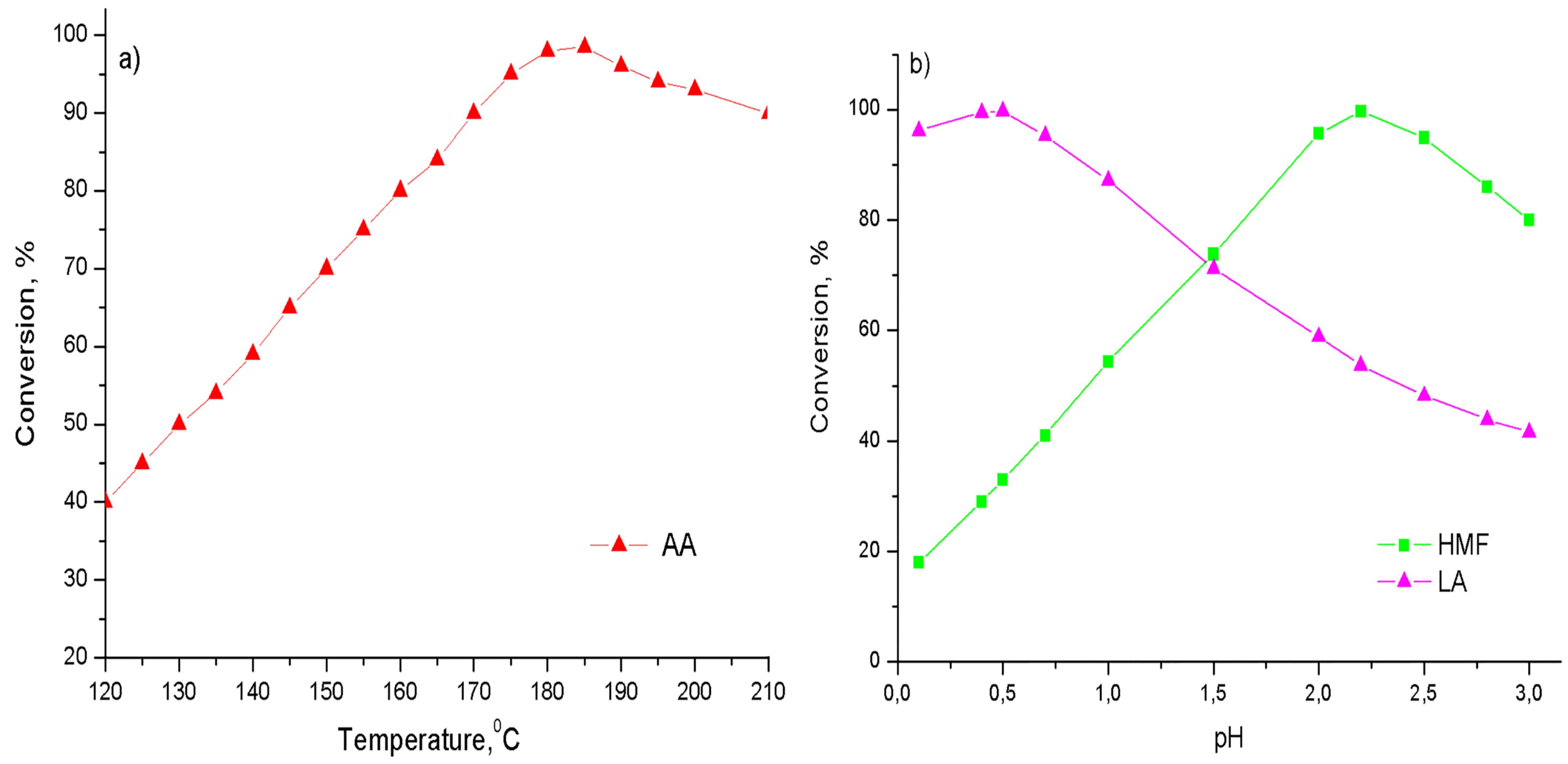
Experimental

LA was synthesized by the dehydration of fructose in a strongly acidic aqueous medium, using diluted hydrochloric acid, and subjected to microwave irradiation at different operational conditions. LA was further used in two subsequent steps of peroxidation and dehydration to obtain 3-hydroxypropanoic acid and maleic anhydride (MA) and acrylic acid (AA), respectively, which could be used for acrylic ester synthesis which could be used as a monomer in a polyacrylate production (Figure 1).



Results and disscusion

The structure of the synthesized compound was confirmed by elemental analysis, ATR-FTIR and NMR spectroscopy.



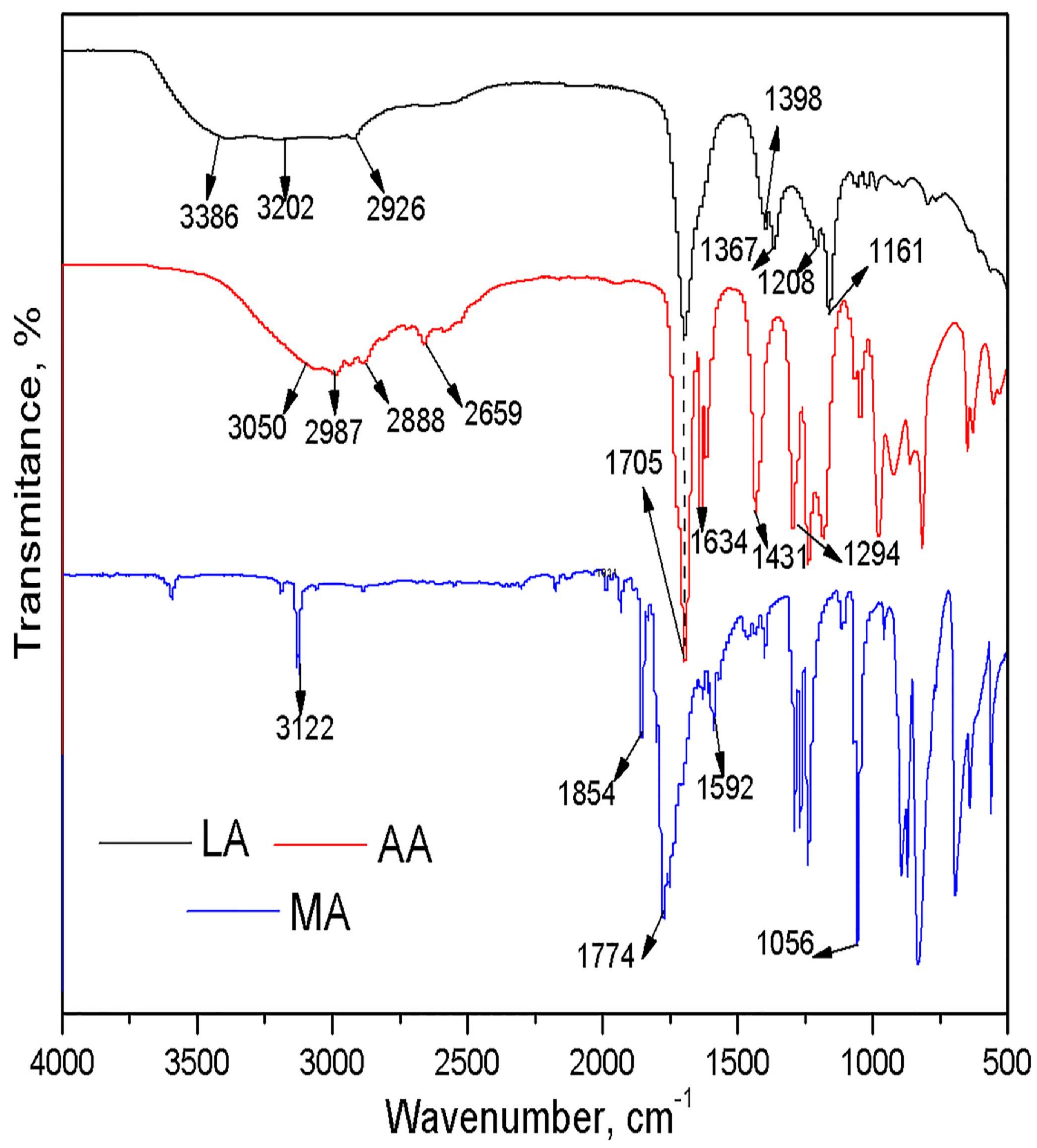


Figure 1 Optimization procedure of HMF and its utilization routes for chemicals

Conclusions

Results of the LA optimization with respect to reaction time show that the highest yield and purity were obtained for 5 min, and a further increase of reaction time influence the increase of the levulinic acid production (Fig 2. and 3a). On the other hand, lower pH is favorable for LA production (~0.5), while higher (~2.3) leads to a higher yield of HMF (Fig. 3b). The usefulness of the applied optimization method was confirmed by oxidation (KOH/H_2O_2) to produce 3-hydroxypropionic acid (3-HPA) and maleic anhydride (MA) as useful reactants in bio-renewable polyester synthesis.

Reference

[1] Joseph J. Bozell et al., Resources, Conservation and Recycling 28 (2000) 227-239

Acknowledgements

The authors acknowledge financial support from Ministry of Education, Science and Technological development of Serbia, Project Nos. TR 34028, OI 172013 and OI 176018.