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The influence of AC and Ni/AC catalyst in the antioxidant additives production from argan shells lignin.

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Abstract

In this work, the production of antioxidant additives via the hydrothermal treatment of lignin from argan shells (agricultural waste) was evaluated. Specifically, the effect of using a catalyst supported on activated carbon which had been prepared from the same waste (argan shells), has been studied.

Material characterization

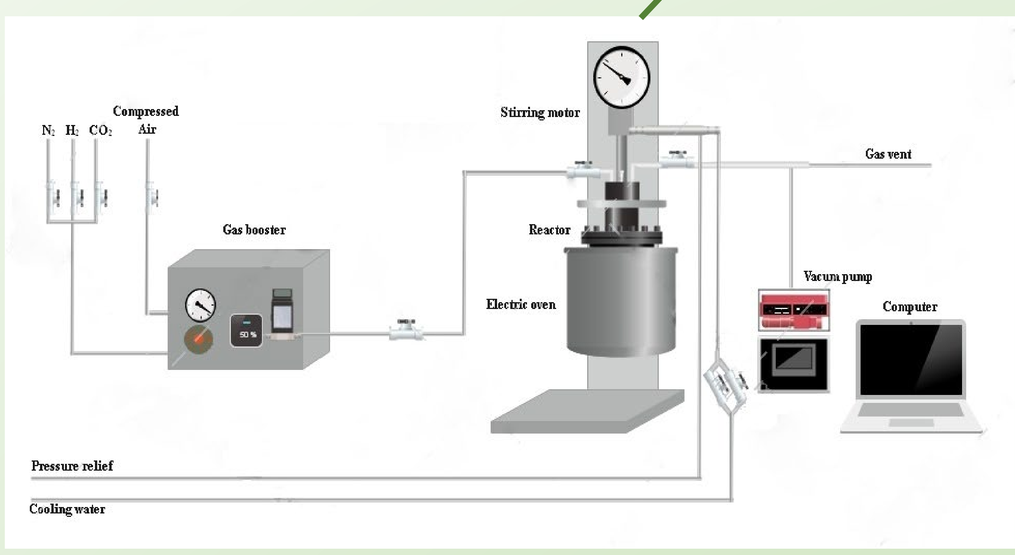
Parameter	AS	ASL
Proximate analysis (wt. % ar. basis)		
Ash	0.30 ± 0.01	60.1 ± 0.5
Moisture	6.5 ± 0.1	n.d
Volatile matter	75.7 ± 0.1	n.d
Fixed Carbon	17.5 ± 0.2	n.d
Ultimate analysis (wt. % ar. basis)		
C	47.5 ± 0.2	29.4 ± 0.1
H	6.5 ± 0.1	3.04 ± 0.04
N	0.177 ± 0.003	0.23 ± 0.02
O[a]	45.5 ± 0.2	7 ± 1
HHV (MJ/kg)	18.98 ± 0.02	10.33 ± 0.04

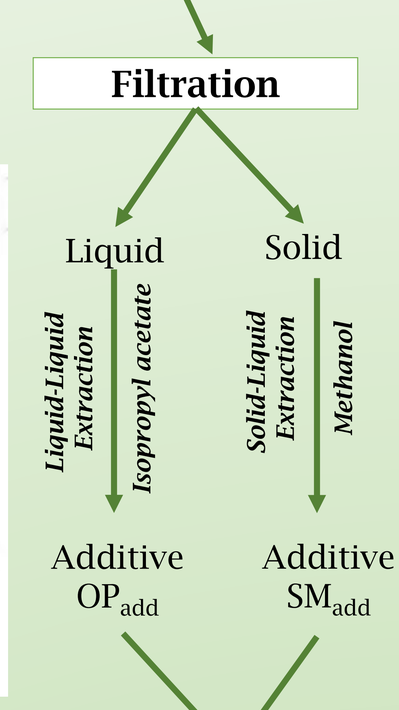
	AC	Ni/AC
Ultimate analysis (wt.% ar. basis)		
C	94.9 ± 0.3	82.7 ± 0.3
H	0.55 ± 0.04	<0.05
N	1.0 ± 0.1	<0.05
O[a]	2.0 ± 0.1	n.d
Ash	1.5 ± 0.2	22.2 ± 0.1
Textural characterization		
S_{BET} (m^2/g)	1149 ± 64	797.5
Micropore volume (cm^3/g)	0.42 ± 0.02	0.3
Average pore size (nm)	0.86 ± 0.03	0.87

* Calculated by difference ; n.d: no determined

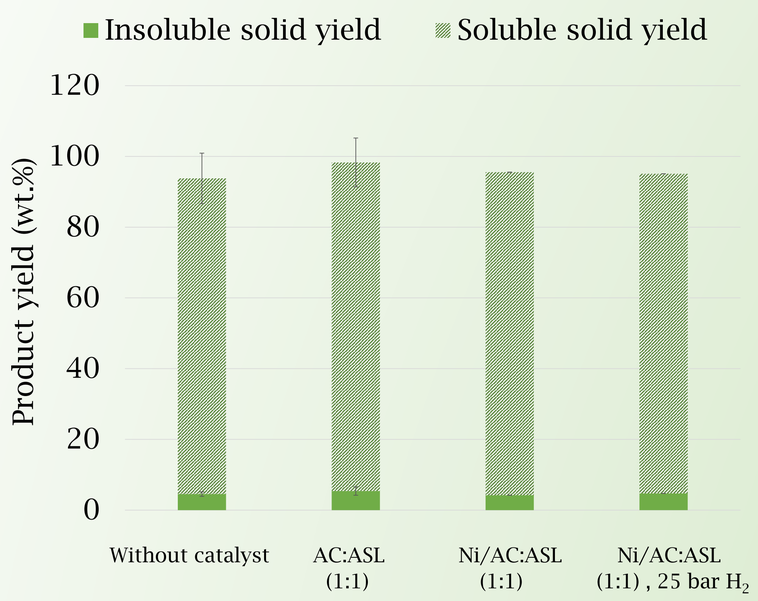
Experimental

Operational conditions
Temperature: 300 °C
Reaction time: 1 h



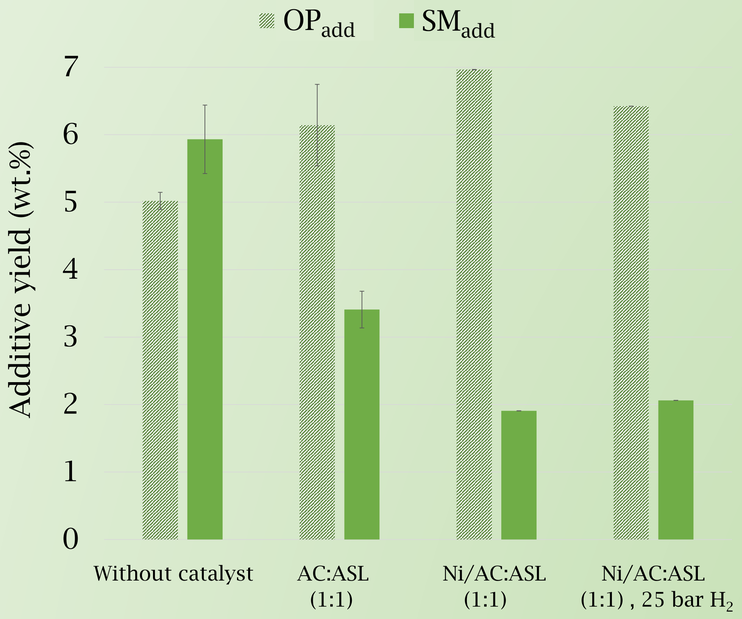


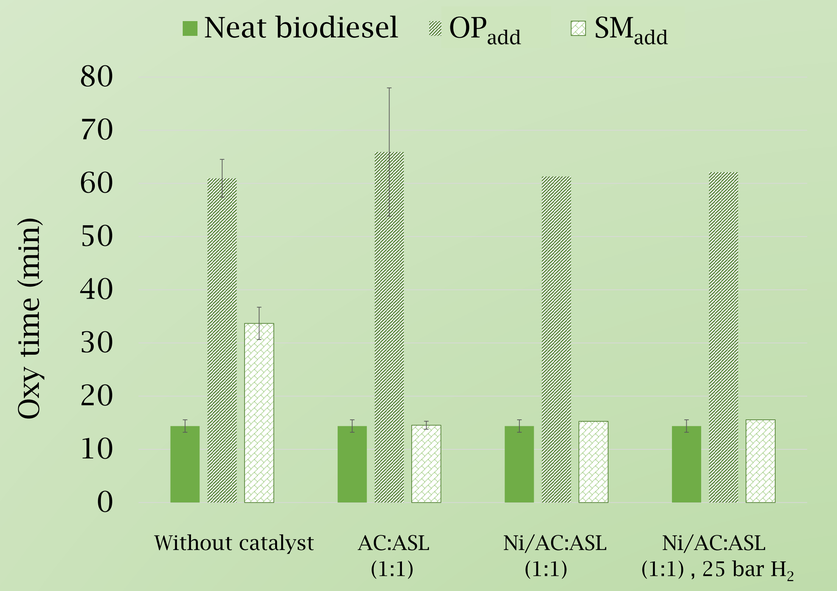
Results



- A minimal amount of gases was generated in the process.
- No differences in the product distribution were observed when loading AC or Ni/AC.

- OP_{add} yield enhanced by the presence of the catalyst, obtaining the highest value of 7 wt.% in Ni/AC presence.
- SM_{add} yield decreased in the presence of either AC or Ni/AC.





- Doping biodiesel with OP_{add} additives improved the oxidation time from 14.4 to 60 min.
- No significant effect of using a catalyst or H_2 atmosphere was found.
- Doping biodiesel with SM_{add} did not improved the oxidation time when using AC or Ni/AC in the preparation, while this fraction has slight improvement in the antioxidant capacity when no catalyst or AC were load to the process.

Conclusions

The main conclusion obtained in this work is that it is possible to produce effective additives from the depolymerization of lignin extracted from argan nutshells, which could be useful for improving the oxidation stability of biofuels. Adding activated carbon (with or without Ni loading) into the reaction medium increased the additive production, but no significant differences in its antioxidant potential were found when blended with biodiesel at a small dosage.

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