8TH INTERNATIONAL CONFERENCE
ON SUSTAINABLE SOLID WASTE MANAGEMENT 2021

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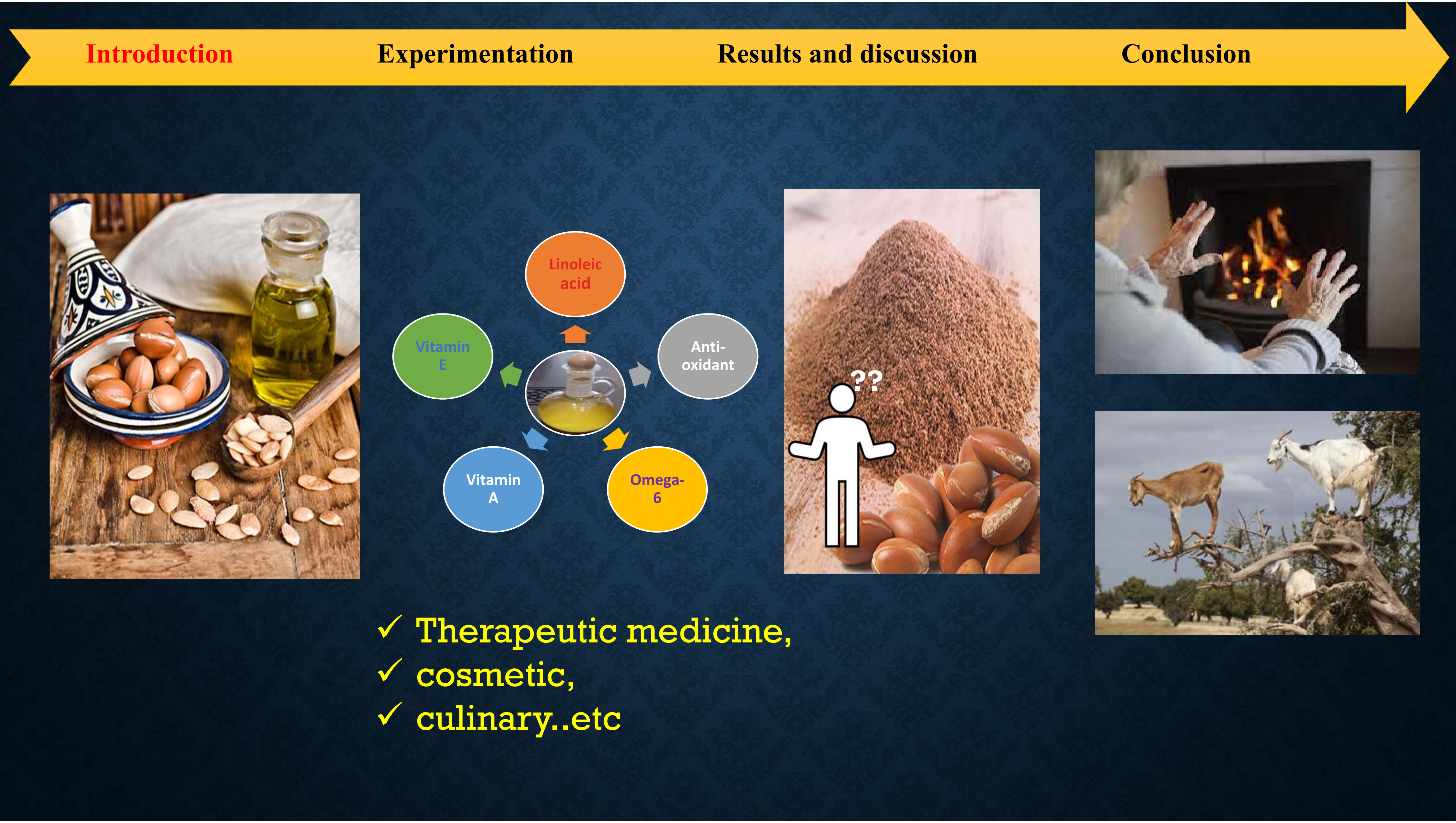
Assessment of argan shell wastes as precursors of nanoporous carbon materials

Presented by Asma Mokhati


Introduction
Experimentation
Results and discussion
Conclusion
Linoleic acid
Anti-oxidant
Omega-6
Vitamin A
Vitamin E
??
✓ Therapeutic medicine,
✓ cosmetic,
✓ culinary..etc

Introduction Experimentation Results and discussion Conclusion

Material preparations

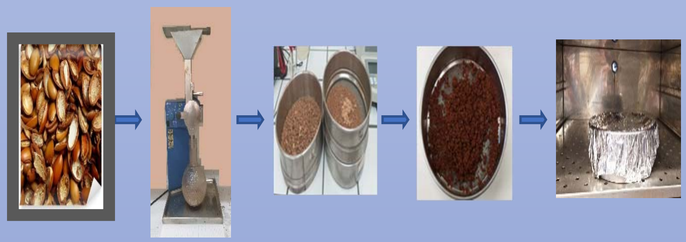


Figure 1: Precursor preparation

Porous carbons synthesis

- Argan nut shells
- Carbonization at 400 °C/1h
- Biochar +KOH
- HCl (3h)
- Washing
- Drying

Optimum carbon characterization

- ❖ Elemental analyses
- ❖ Ash and pH_{PZC}
- ❖ SEM, FTIR, and TGA

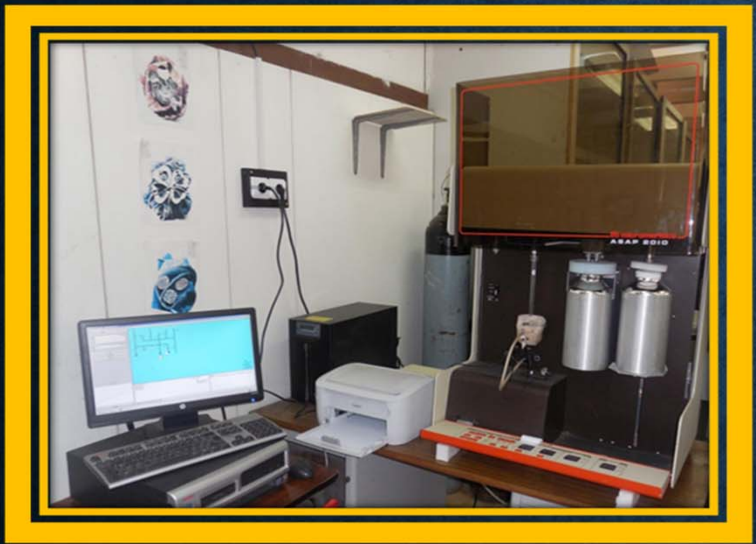


Figure 2: Surface analyzer ASAP 2010.

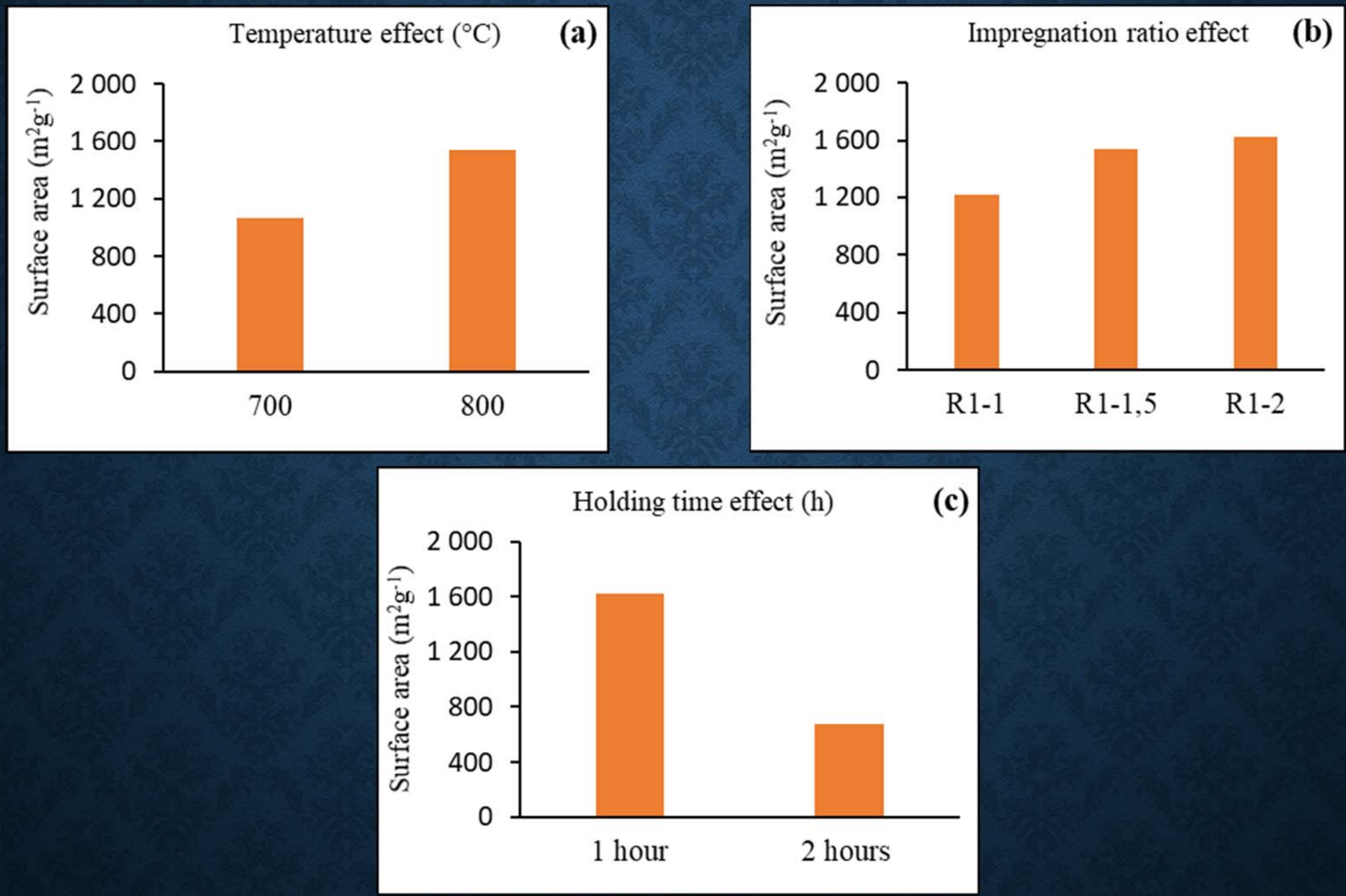


Figure 3: Comparison graphic to evaluate the effect of various activation conditions on the specific surface area of ACs

- Impregnation ratio 1-2 char/KOH (w/w)
- Carbonization temperature 800 °C
- Holding time 1 hour

1624 m^2g^{-1} → **ACK**

Table 1: Results of elemental analysis, ash contents and pH_{PZC} of biomass and ACK

	ANS	ACK
C (wt.%)	47.84	69.86
H (wt.%)	6.54	1.74
N (wt.%)	0.33	0.39
S (wt.%)	<0.03	0.2
O* (wt.%)	45.20	26.86
Ashes	0.065	0.95
pHPZC	n.d	7,04

n.d. – not determined

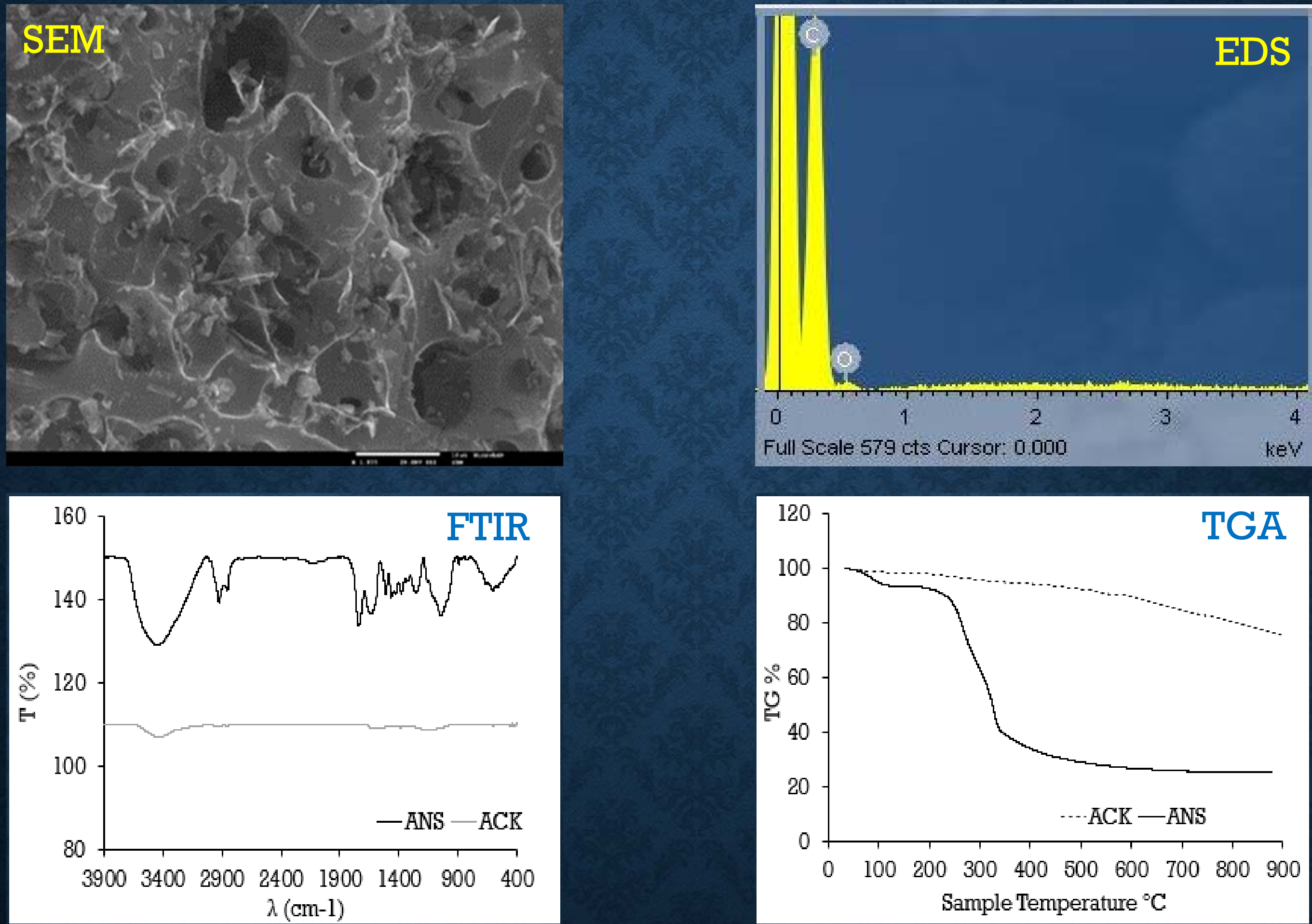
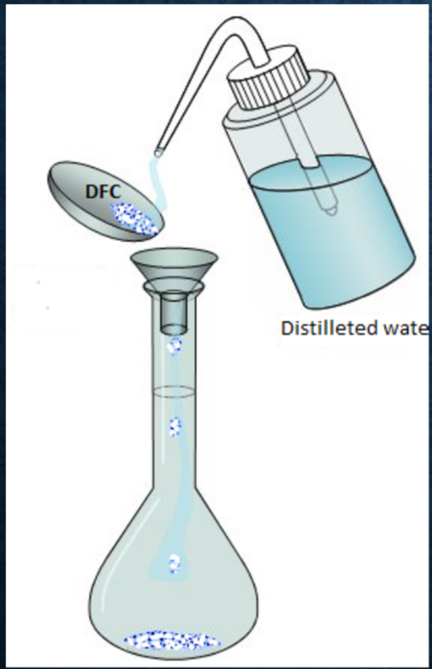


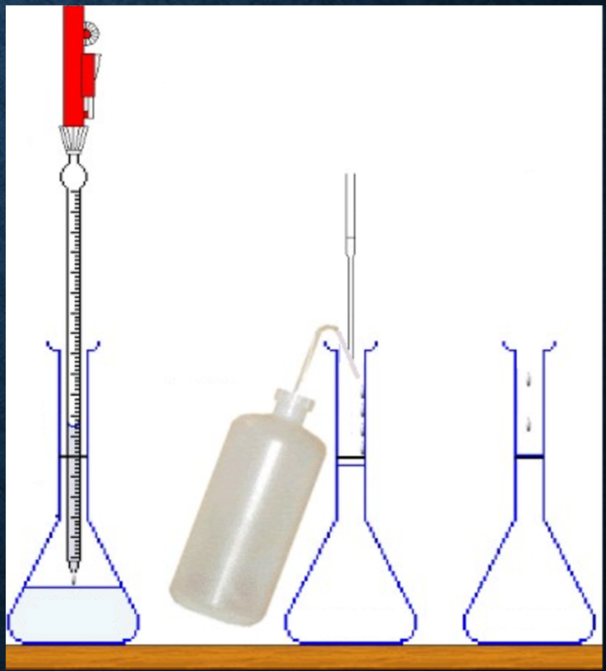
Figure 4: ACK characterizations

Adsorption studies

- DCF preparation



Dilution



Batch-Sorption experiments

10 mg of adsorbent

+

(25 mL, 100 mg L^{-1}) Of DCF

↓

stirring 200 rpm to 5 until 1440 min maximum

10 mg of adsorbent

+

(25 mL, 20-200 mg L^{-1}) Of DCF

↓

stirring 200 rpm/ 240 min

UV-Vis at 274 nm

$$q_t = \frac{(C_0 - C_f) \times V}{m}$$

Adsorption studies

Kinetic models:

PFO $q_t = q_e \times (1 - e^{-k_1 \times t})$

PSO $q_t = \frac{q_e^2 \times k_2 \times t}{1+(k_2 \times q_e \times t)}$

Isotherm models:

Langmuir $q_e = \frac{q_m K_L C_e}{1+K_L C_e}$

Freundlich $q_e = K_F Ce^{1/n}$

Sips $q_e = \frac{q_{ms} K_S (C_e)^{n_S}}{1+K_S (C_e)^{n_S}}$

Table 2: Kinetic parameters obtained

Kinetic parameters	
Pseudo-first order	
R^2	0.972
q_e (mg g^{-1})	171
k_1 (min^{-1})	0.095
Pseudo-second order	
R^2	0.986
qe (mg g^{-1})	175
k_2 (g mg^{-1} min^{-1})	0.0009

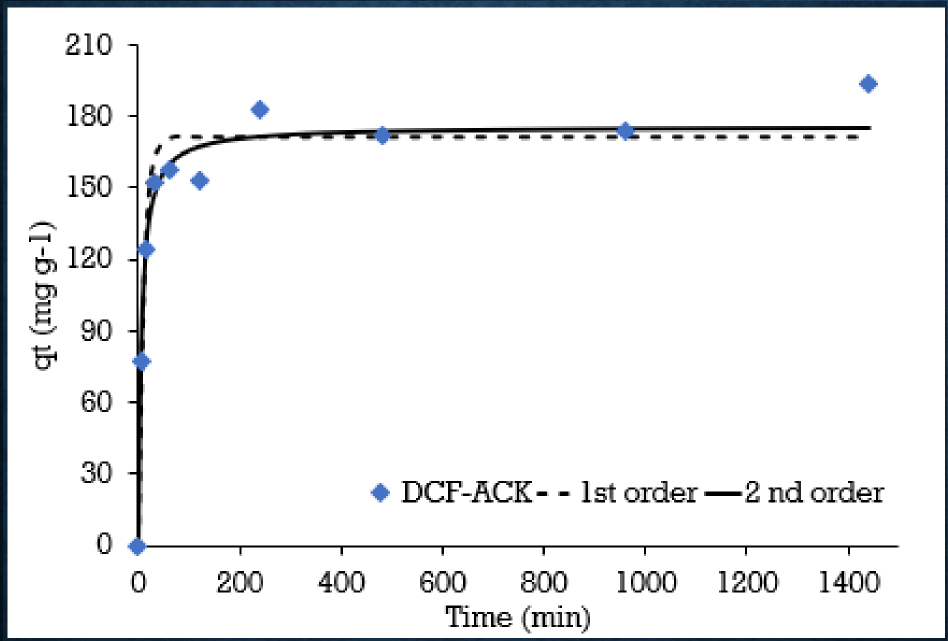


Figure 5: Kinetic data of DCF onto ACK.

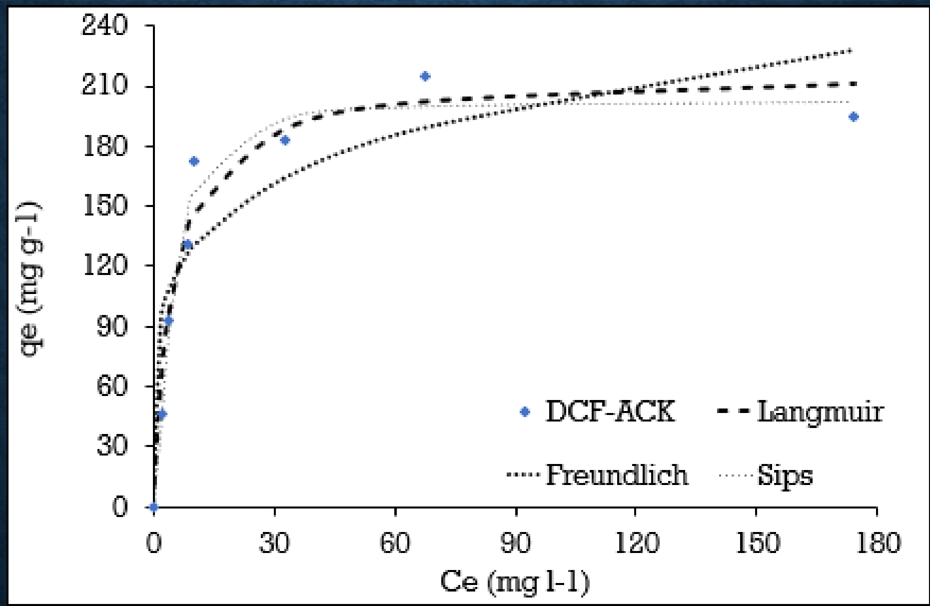


Figure 6: Adsorption isotherms of DCF onto ACK carbon

Table 3: . Estimated parameter values of models for adsorption experimental data of DCF onto ACK.

Langmuir			**Freundlich**			**Sips**			
q_m	K_L	R^2	K_F	n	R^2	q_m	Ks	n_s	R^2
217	0.2	**0.964**	82.5	5	0.842	217	0.01	0.5	**0.964**

Table 4: DCF maximum adsorption capacities of several biomass derived ACs

Adsorbate	Biomass precursor	S_{BET} ($m^2\ g^{-1}$)	q_m ($mg\ g^{-1}$)	Reference
DCF	Argan nut shell	**1624**	**217**	**This work**
	Potato peel waste	866	68.5	(Bernardo et al. 2016)
	Loblolly pine chip	1151 - 1360	214 - 372	(Jung et al. 2015)
	Olive waste cake	793	56.2	(Baccar et al. 2012)
	Pine and Onopordum acanthium L. sawdust	796	257	(Álvarez-Torrellas et al. 2016)
	Pine sawdust	176	123	(Thi Minh Tam et al. 2019)
	Orange peels	184 - 457	5.61 - 144	(Tomul et al. 2019)
	Tea waste	416 - 865	74.6 – 91.2	(Malhotra, Suresh, and Garg 2018)
	Knotweed plants	140 - 475	17.7 – 86.8	(Koutník, Vráblová, and Bednárek 2020)
	Sucrose	375 - 753	70 - 207	(Moral-Rodríguez et al. 2019)

- ✓ This work does not only open a new way to valorize argan nut shells but also presents a simple and sustainable approach to synthesize nanoporous carbon materials.

- ✓ Argan nutshell-derived carbon presented high uptake capacity for Diclofenac, compared with other porous carbons found in the literature.

Thank you for your attention