Supplementary information

The beneficiation of asphalt waste through conversion into an efficient activated carbon adsorbent for Diazinon Pesticide, optimized through Response Surface Methodology

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Table 1S. Benefits and drawbacks of the reported treatment techniques for pesticides (1-3).

Method	Advantages	Disadvantages
Fenton oxidation	Efficient at treating industrial-scale pesticide-contaminated wastewater, facilitates degradation and mineralization of pesticides. and proven and established technology	Formation of sludge occurs, necessitating operation under acidic conditions at pH 3, mandating the neutralization of pH.
Chlorination	Straightforward maintenance and operation, cost-effective. readily accessible	Use of extremely corrosive chemicals raises concerns about odor and taste, generation of by-products.
Photochemical degradation	Absence of sludge generation, rapid treatment process, utilization of solar energy, well-established technology	Generation of by-products, high energy and cost requirements, challenges with UV penetration
Biological treatment	Cost-effective, demonstrates high efficiency, environmentally friendly, requires no regeneration, achieves complete mineralization of contaminants to CO_2 and H_2O without intermediate buildup	Breakdown and deterioration of biosorbents, and ineffectiveness in the absence of conducive environmental conditions for microbial growth
Membrane filtration	Requires small space for set up, and it is highly effective	Significant investment and operational expenses, challenges with membrane fouling

Table 2S. Synthesis parameters and their levels.

	Levels

Parameters	Units			
Activation temperature	℃	500	600	700
Activation time	min	45	60	75
Activation ratio	g/g	1	2	3

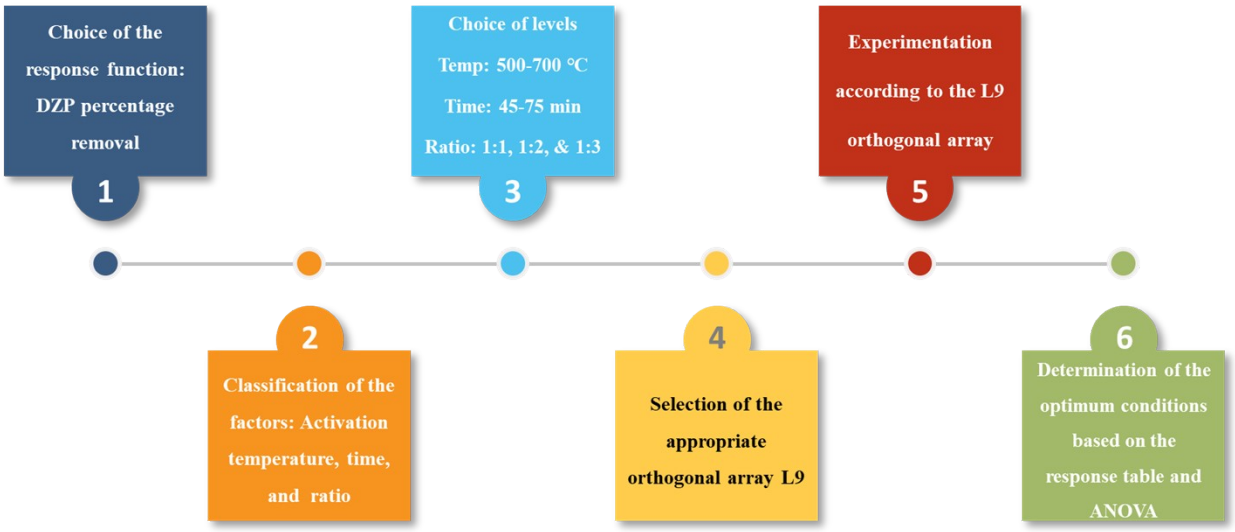

Figure 1S. The robust design methodology according to Taguchi for the preparation of AC.

Table 3S. Experimental ranges and levels of independent test variables

		Ranges and levels				
Parameters	Units	-α	-1	0	+1	+α
Adsorbent dosage	mg	23	30	40	50	57
DP initial concentration	mg/L	66	100	150	200	234
pH		1	3	5.5	8	10

Table 4S. Design structure and matrix of DP adsorption experiment by CCD

	Coded values			Actual values		
Run	Adsorbent	Initial	pH	Adsorbent	Initial	pH

	dosage (mg)	concentration (mg/L)		dosage (mg)	concentration (mg/L)	
1	-1	-1	-1	30	100	3
2	1	-1	-1	50	100	3
3	-1	1	-1	30	200	3
4	1	1	-1	50	200	3
5	-1	-1	1	30	100	8
6	1	-1	1	50	100	8
7	-1	1	1	30	200	8
8	1	1	1	50	200	8
9	-1.68	0	0	23	150	5.5
10	1.68	0	0	57	150	5.5
11	0	-1.68	0	40	66	5.5
12	0	1.68	0	40	234	5.5
13	0	0	-1.68	40	150	1
14	0	0	1.68	40	150	10
15	0	0	0	40	150	5.5
16	0	0	0	40	150	5.5
17	0	0	0	40	150	5.5
18	0	0	0	40	150	5.5
19	0	0	0	40	150	5.5
20	0	0	0	40	150	5.5

Table 5S. Different forms of kinetics models

Model	Equation	Plot	Parameters
Pseudo first order	$Log(q_e - q_t) = logq_e - \left(\frac{}{2.}\right.$	$Log(q_e - q_t)\ vs$	q_e = Adsorption capacity at time t (mg/g) K_1 = Rate constant of pseudo-first order (min^{-1})
Pseudo second order	$\frac{t}{q_t} = \frac{1}{K_2 q_e^2} + \left(\frac{1}{q_e}\right)t$	$\frac{t}{q_t}\ vs\ t$	K_2 = Rate constant of pseudo-second order ($g/mg \cdot min^{-1}$)

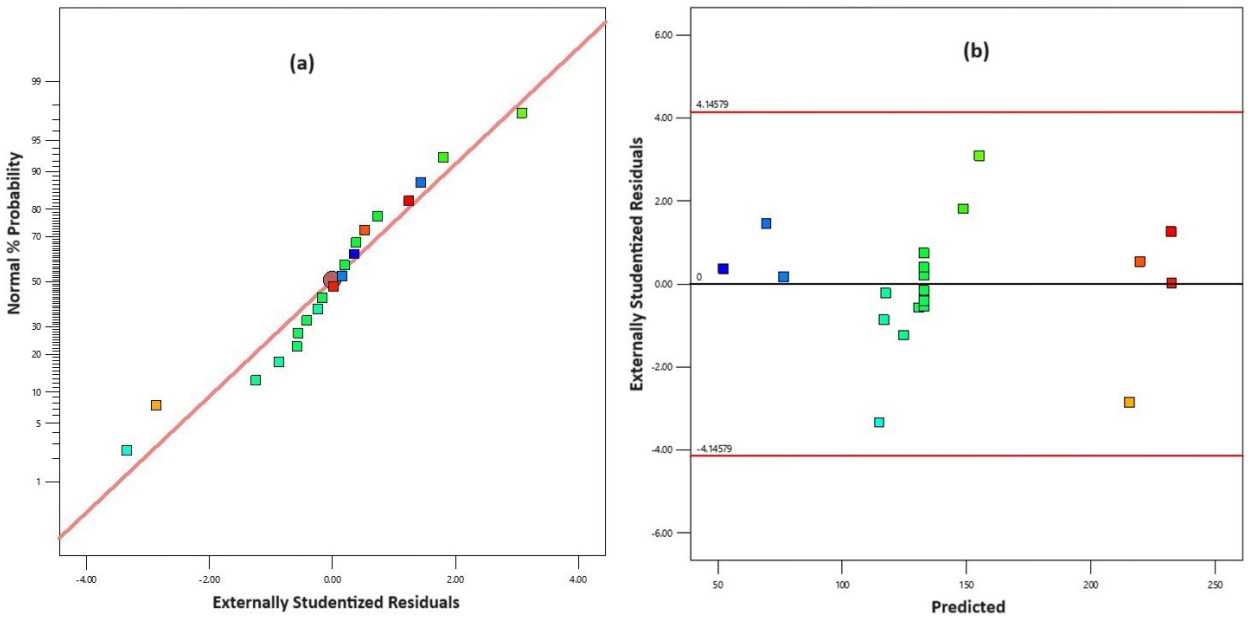

Figure 2S. Adequacy plots of the quadratic model.

References

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