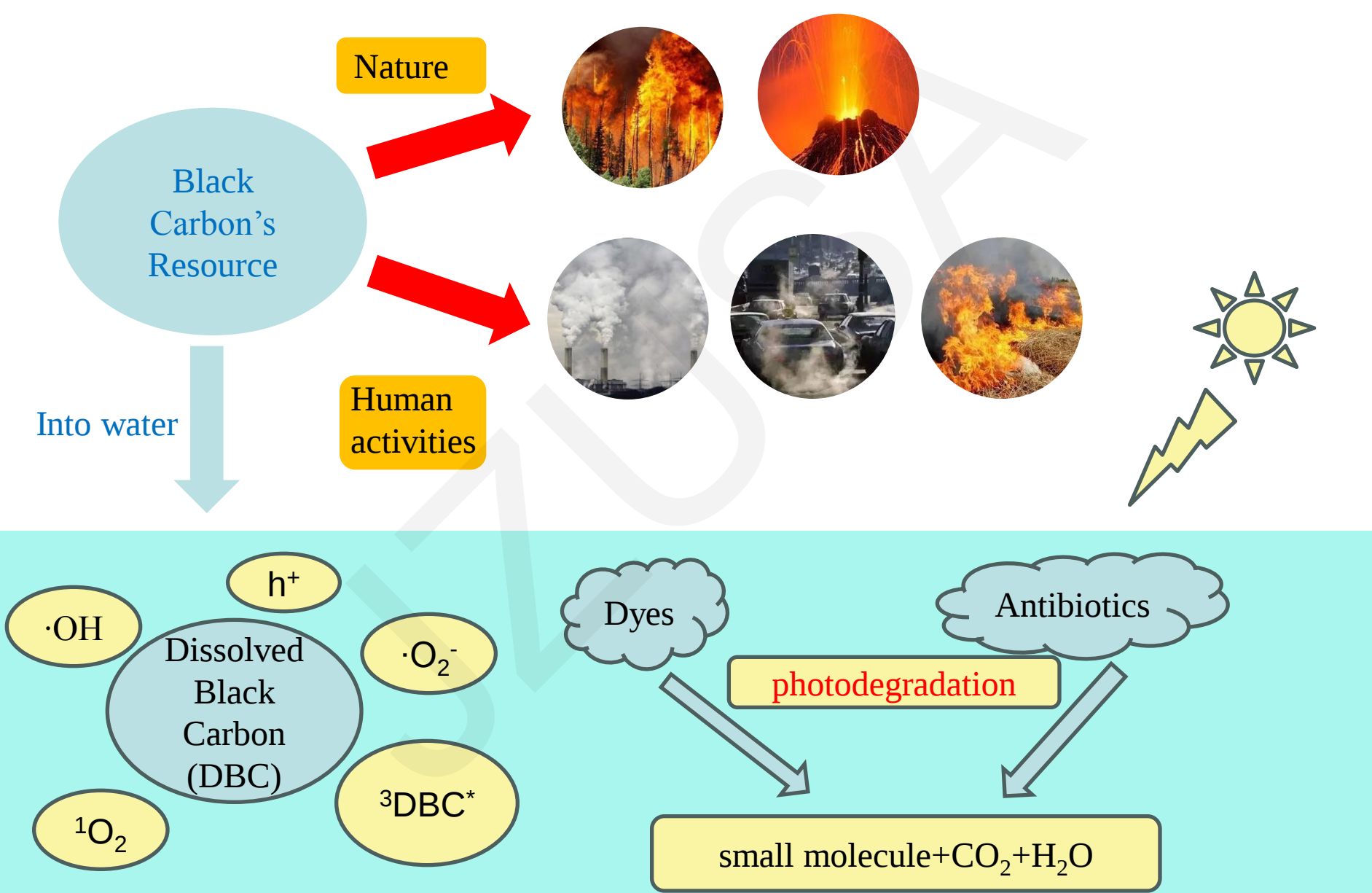


N-doping offering higher photodegradation performance of dissolved black carbon for organic pollutants: experimental and theoretical studies

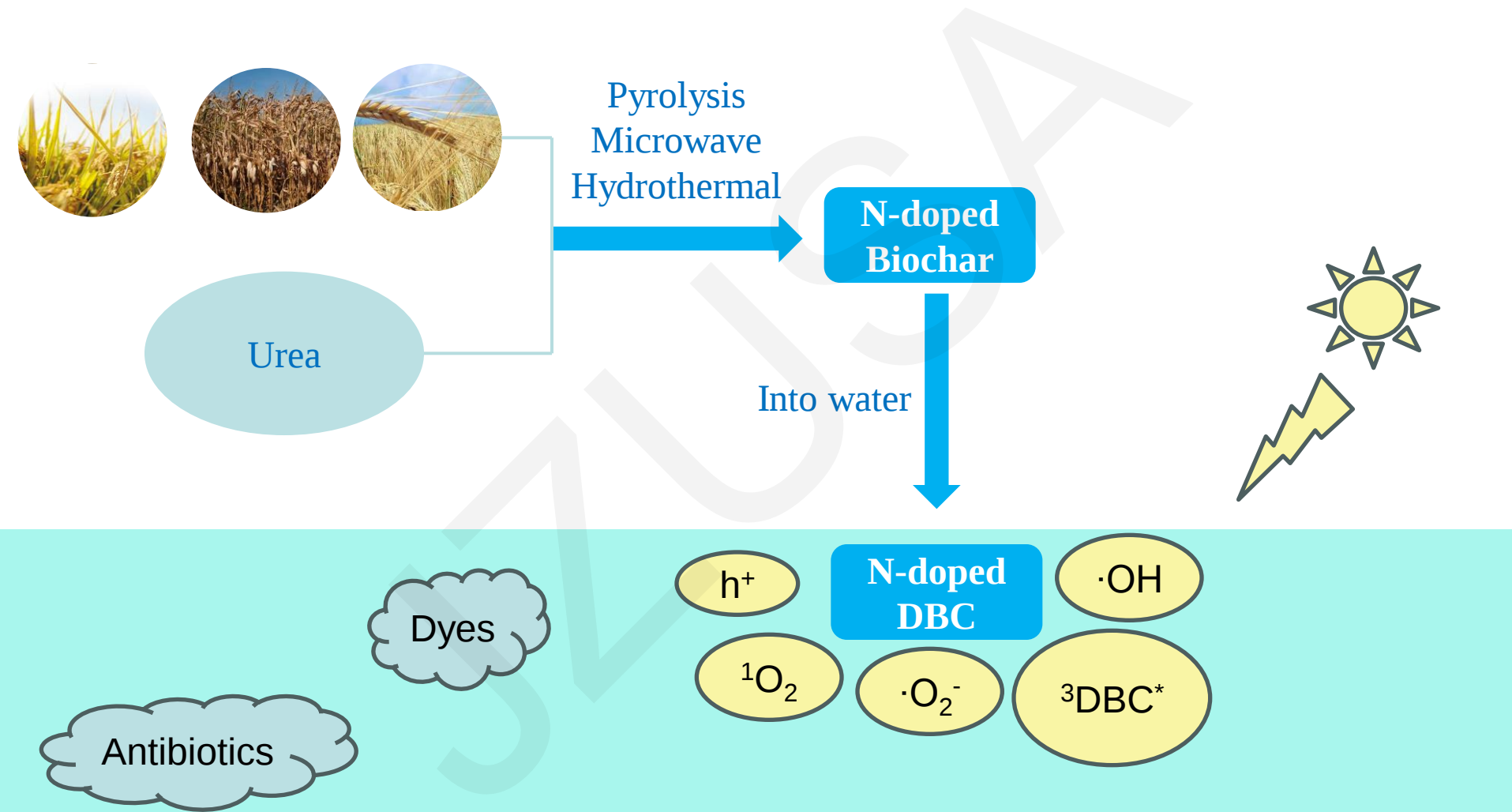
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Dissolved Black Carbon in the Environment



N-doped DBC in the Environment



What's the effect of N-doping to the photodegradation of DBC for dyes and antibiotics?

Results and Discussion

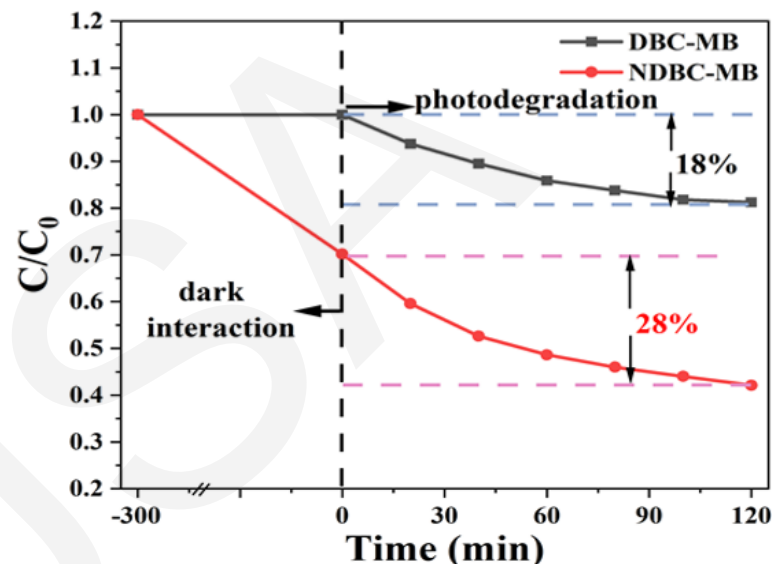
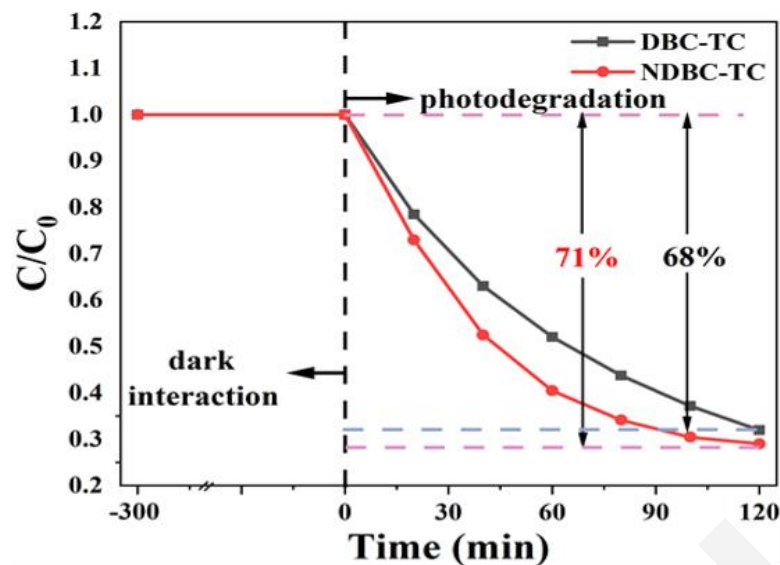


Fig. 1. Dark interaction and photodegradation performance of NDBC and DBC for TC; dark interaction and photodegradation performance of NDBC and DBC for MB.

The degradation performance of nitrogen-doped DBC (NDBC) for tetracycline (TC) (71%) is better than DBC for TC (68%).

The degradation performance of NDBC for Methylene (MB) (28%) is better than DBC for MB (18%).

In a word, N-doping offers higher photodegradation performance for DBC to TC or MB.

Results and Discussion

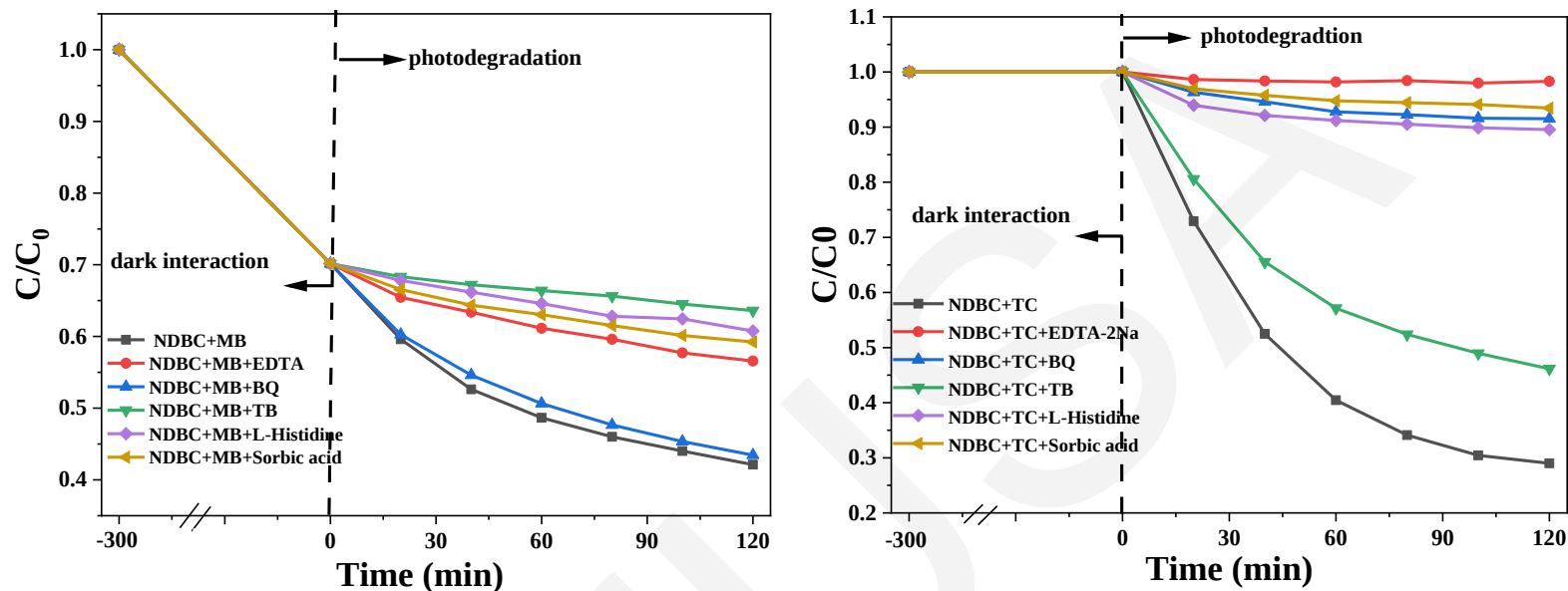


Fig. 2. Reactive species quenching experiments for TC photodegradation by NDBC; (b) reactive species quenching experiments for MB photodegradation by NDBC.

1. h^+ , O_2^- , 1O_2 , and $^3NDBC^*$ are the main photoactive species involved in TC photodegradation by NDBC. These findings are the same as those for TC photodegradation by DBC.
2. OH , 1O_2 , $^3NDBC^*$ and h^+ must be the main photoactive species during MB photodegradation by NDBC. During MB photodegradation by DBC, O_2^- , 1O_2 , and $^3DBC^*$ were involved, while OH was not found.

Results and Discussion

■ Band structures theory explain well the results

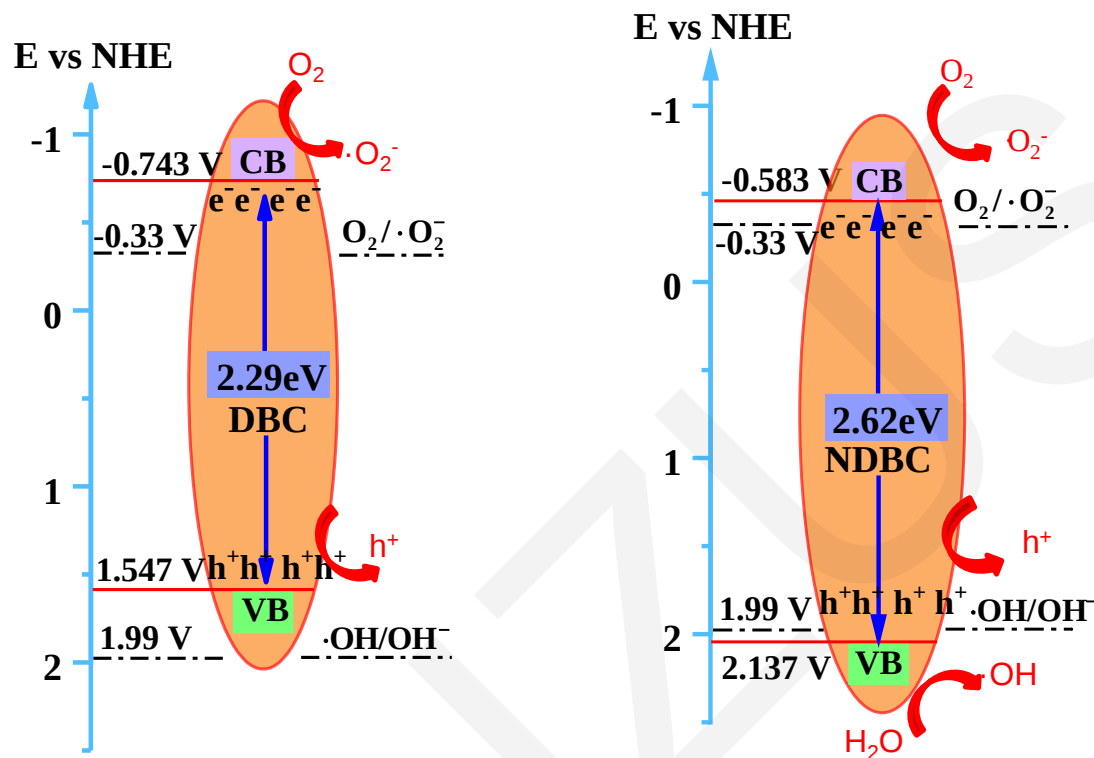


Fig. 3. Band structures of NDBC and DBC.

Band structure theory explains well why nitrogen-doping DBC promotes higher photodegradation performance of TC and MB than DBC;

NDBC produces $\cdot\text{O}_2^-$ and $\cdot\text{OH}$, while DBC can only produce $\cdot\text{O}_2^-$.

Conclusions

- nitrogen doping promotes photodegradation performance of biochar-derived DBC for TC and MB.

That's because

- 1) N-doping increases the valence-band energy and the band gap, as well as the separation efficiency between the photo-generated electrons and holes.
- 2) the photo-stabilities of TC and MB contribute to better degradation of TC by NDBC.

- The photodegradation intermediates of TC produced by NDBC have less aromatic structure and are less toxic than those produced by DBC. This information will be helpful in thoroughly understanding the photochemical behavior of nitrogen-doped dissolved black carbon.