

What are the limitations of the 'Lotus Effect'?

The 'Lotus effect' is the self cleaning property under a gentle stream of water; exhibited by a structured hydrophobic surface possessing a fractal dimension and tiny air pockets. This essentially places the following constraints:

- Preservation of hydrophobicity: Since the intrinsic hydrophobic nature of the surface has to be conserved, the use of surfactants has deleterious influence on the 'Lotus Effect' due to the increased hydrophilicity.
- Availability of air: The phenomenon essentially requires the presence of microscopic air pockets on the surface. Hence the self cleaning ability is lost upon immersion of the substrate in water. Hence the under-water surfaces like ship bottoms cannot be made hydrophobic based on this principle.
- Availability of water: These surfaces are not 'dirt repellent'; but are easily cleanable by water drops. Since the self cleaning ability depends upon the uptake of dirt by rolling water droplets, the surfaces will need intermittent exposure of water like the rain or dew or condensate for their cleaning.
- Optical property: The structured surface disturbs the reflection of light incident on it and hence the transparency and optical clarity are not of high order. This is indeed the case with the lotus leaves. Therefore, only the flat, hazy, low-gloss and matt appearing surfaces are possible with the lotus effect.
- Mechanical damage: Any disturbance of the patterned micro/nano structure of the surface will reduce the contact angle and hydrophobicity. Therefore the surfaces that are subjected to severe scrubbing, abrasion or erosion will lose their self cleaning ability. Hence, the non-contact or low-contact surfaces like exterior paints, roof tiles and structural glass are the suitable candidates for employing self cleaning effect. Fortuitously, these are the very surfaces which get soiled and are inaccessible to cleaning.

The above factors may be kept in view while designing the self-cleaning super hydrophobic coatings.