Amazing events in a glass of water

Have you ever thought about what happens when a pill which has to treat for example your headache, is immersed into water (or any other fluid) and sinks to the bottom of a glass? A number of processes start (also present in the gastro-intestinal tract) which ultimately decide whether the drug has a chance to get into your body to carry out its role of safely treating your complaints.

While water erodes the pill, solid particles of the drug are released into the water and start to dissolve. Whether or not they finally dissolve depend on several factors, properties or conditions. Important are the solubility of the drug, the shape and size of the particles, their total amount in the pill and also whether the dissolved drug is stable in the given medium. Similarly as in the case of carbon, the molecules that build up the drug particles may be in various physical forms (like coal and diamonds). These forms (called polymorphic forms) may have substantially different properties (one can be e.g. very soluble and the other almost insoluble).

Depending on the drug amount in the glass the particles will behave differently. They can dissolve totally, however at water scarcity or very low solubility of the drug unexpected observations can be made. You may observe that large undissolved particles will grow while the small ones will disappear from the medium (as an economic parallel – large companies just absorb the small ones), or that particles having lower solubility will grow on the particles having higher solubility (again the economic reflection – solid based companies may grow while weekly based, chaotic companies bankrupt). The final distribution of the drug between the medium and various polymorphic forms will depend also on the initial size distribution of the drug particles in the pill and its disintegration.

Each of us have observed when stirring a cup of coffee that the sugar in it dissolves more quickly. This is of course also true in the aforementioned case of our glass of water with the pill. However, if the drug particles in the pill are really very small, they will dissolve extremely rapidly and independently on the stirring speed. Moreover those tiny particles are able to cause drug concentration remarkable higher than the larger ones. This property of the tiny particles (nanoparticles) represents an advantage when dealing with substances having low solubility. Nevertheless since this increased ability of tiny particles is strongly dependent on their actual size, drug powders used in pills manufactured under poor control may result in unpredictable concentrations possible jeopardizing the safety and efficacy of the treatment.

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