

20.4 THE PHOSPHORUS CYCLE

Phosphorus plays an essential role in almost every step of organic synthesis. This element is more abundant in living organisms than in abiotic system. The main reservoirs of phosphorus on Earth are living organisms and relatively insoluble calcium phosphate deposits in rocks and sediments. Phosphorus is solubilised from its Dissolved Phosphates deposits under conditions of low pH and is taken up by plants, which pass it on to the food chain. Plant and animal Phosphatising Bacteria Phosphates in plants secretion and decomposition of dead organic

material bring it back to the Decomposition surrounding medium. A part of this Solubilisation Phosphates in animals phosphorus is leached away to oceans through rivers where it forms marine deposits being available to fishes and marine birds which convert it into phosphate rocks, guano-deposits and bone deposits as relatively insoluble tricalcium phosphate. Therefore, only a little amount of phosphorus returns to land from oceans through fishes and guano birds while much of it is lost to relatively deep-sea deposits. Fig 20.3 depicts a highly simplified phosphorus cycle.

Our understanding of the rate of transfer of phosphorus between various components of the cycle is very poor. It is likely that only up to 1900 A.D. phosphorus cycle was in a balanced state in which the rate of its solubilisation was almost equal to the rate of its transfer through rivers to oceans. However, rapid soil erosion has greatly enhanced the rate of loss of phosphorus from soils to the sea. Hence, phosphorus has to be added to agricultural fields to sustain productivity. The industrial production of phosphorus overtook its natural rate of cycling around 1910 A.D. and about 70–80% of the industrially produced phosphorus is ultimately applied to agricultural fields. The remaining phosphorus is usually used in soaps, detergents and water softening plants, which is discharged directly into fresh water systems, or oceans wherein it causes nutrient enrichment, excessive algal growths and other problems.

The practice of burning dead plant material and cow dung cakes instead of using them as natural manures cuts short the natural cycling and releases the primary nutrient rather in one stroke without providing the much needed infra-structure – the humus – to the soil which is helpful in retention of mineral nutrients. The released phosphorus is quickly leached away by running water. Poor yields and subsequent degradation of agricultural land are the major consequences of the practice, which has been prevalent in many Asian countries including India.

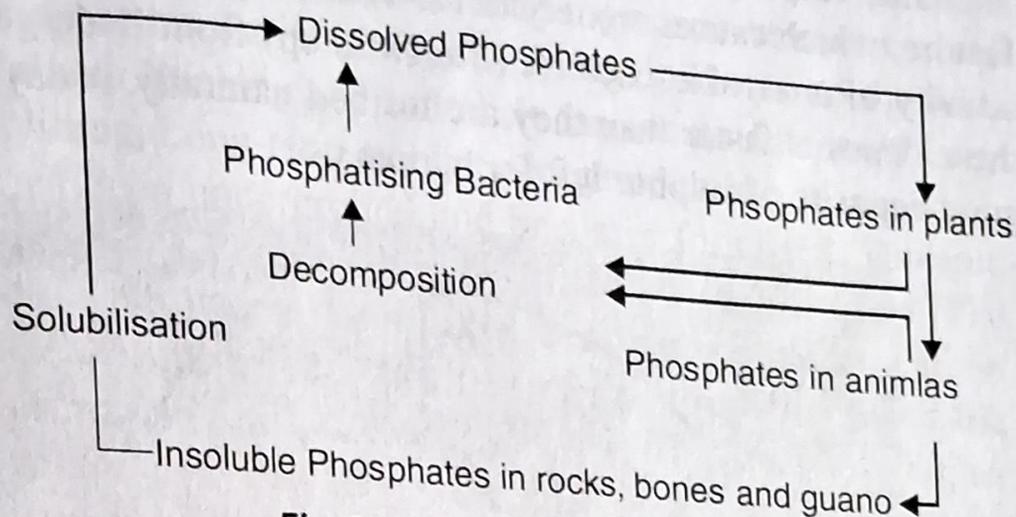


Fig. 20.3. The Phosphorus cycle.