

Chapter 19: Colloids – Properties & Applications

Tula Ram Sahu*

Department of Chemistry, Govt. Minimata Girl's College, Baloda Bazar (CG)

Abstract

In this chapter, an in-depth study on colloids, the nature of colloids, types and their uses in the industry will be presented. Colloids are heterogeneous in the sense that a given substance is suspended in another substance, which is distinctly different in terms of physical and chemical characteristics. The chapter divides the colloids into the lyophilic (solvent-attracting) and the lyophobic (solvent-repelling) systems, and remarks on the principal features of the Brownian motion, the Tyndall effect, the electrophoresis, and the stability mechanisms. Its use is emphasized in paints, inks, foodstuffs, pharmaceuticals, cosmetics and wastewater treatment, with the texture, stability and performance being mainly dictated by the colloidal behavior. The methods of the colloid preparation, coagulation and protective colloid, have also been discussed in the chapter, and the theoretical models related to the real-life processes have been correlated. Concerns regarding colloidal stability, such as electrolyte concentration, pH and temperature, are brought up so that the challenges in the industrial formulations are highlighted. The theory, experiments and applications combined enable students to possess a consistent concept of colloidal chemistry, since it permits them to build and create stable colloidal systems and optimise business procedures. Any application of colloidal systems is pervasive in nature and the empirical world of mankind, whether in the field of material science, chemical engineering, pharmaceuticals, food technology and nanotechnology, all require colloidal science.

Keywords: Colloids, Lyophilic, Lyophobic, Brownian motion, Tyndall effect, Industrial applications, Stability.

*Corresponding author

Dr. Tula Ram Sahu

E-mail address: tulachem123@gmail.com

19.1. Introduction

Colloids are heterogeneous systems where small particles of one material, which is referred to as dispersed phase, are dispersed uniformly throughout another material commonly known as continuous phase. The dispersed phase is usually between 1 nanometer and 1 micrometer (1 nm – 1 μm), which is larger than molecules of real solutions, but smaller than particles of common suspensions. This is the middle size that provides colloids with special characteristics, including Tyndall effect, Brownian motion, and resistance to settling down. Colloids are common in nature, in life and in industry. Examples found in the food industry include milk, butter and mayonnaise where fats, proteins or air is dispersed in water or oil. Colloidal systems (emulsions, gels, and drug delivery nanoparticles) in pharmaceuticals enhance drug bioavailability, solubility as well as controlled release. Paints, inks, and coatings are based on the pigment dispersions in liquid to deliver homogenous hue, endurance, and adhesiveness to the surface. Colloids are important in environmental systems in terms of soil chemistry, water purification, and transport of pollutants, among other biogeochemical processes. Colloids research is an interdisciplinary field of chemistry, physics, and materials science since their large surface area and small size cause an important interfacial phenomenon. To design effective materials, stable formulations, and effective industrial processes, it is imperative to understand colloids.

19.1.1. Historical Background of Colloids

The history of the study of colloids is not recent; it was developed over time as scientists were investigating the nature of the matter between the real solutions and the suspensions.