PeCOD® Case Study #07

Dairy Industry

The PeCOD® method for COD analysis is well suited to the dairy industry as the fast results obtained provide information important for process monitoring and control. The processing of dairy products such as milk, cream, butter, yogurt, cheese and ice cream often produce wastewater effluents containing sugars, proteins, fats and additives that contribute to high COD levels. Regular monitoring of these levels is necessary to reduce product loss and ensure compliance with environmental regulations.

Milk and cream products with varying fat and sugar content were analyzed, untreated, as well as after treatment with acid and heat. The acid and heat-treated samples were pH adjusted with 0.02N sulfuric acid to a pH between 4 and 4.5, heated to 90°C for 10 minutes, and then filtered. This treatment was used for effective removal of fats and proteins. The samples were then diluted prior to testing and sampling for both the traditional dichromate COD method and PeCOD COD method from the same diluted container.

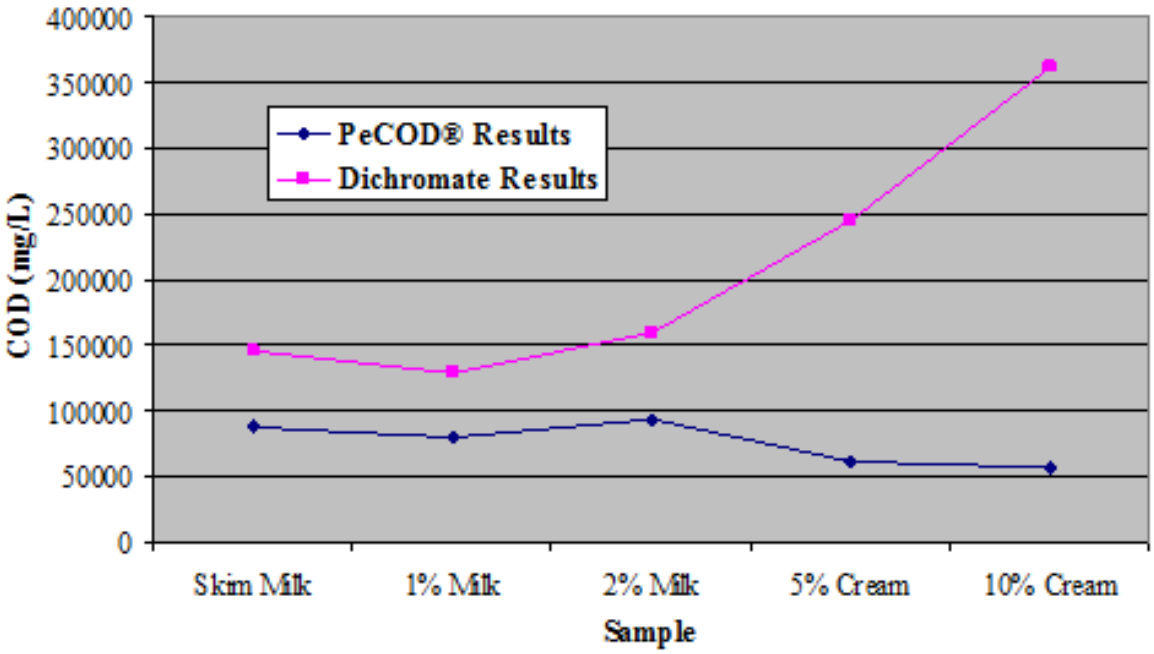

Figure 1: COD values obtained for untreated dairy samples using dichromate analysis and PeCOD® analysis.

From the data in **Figure 1**, it is clear the PeCOD® method produces more consistent results than the dichromate method. In addition, the PeCOD results were found to be lower than the dichromate results, due to the fact that PeCOD® does not fully oxidize large macromolecules such as protein and fat. However, a trend can be observed in **Figure 1** above. For the lower fat samples (skim, 1% and 2% milk), the PeCOD® results were consistently 60% lower than dichromate. As the fat content increased, the relative recovery of PeCOD® to dichromate decreased, indicating that the PeCOD® is not fully oxidizing the fat in these samples. Given the increased discrepancy between methods with increased fat content, it was clear that a pretreatment was required to assist in fat breakdown for these samples before oxidation using the PeCOD® method. To denature proteins, the samples were pH-adjusted to a pH between 4 and 4.5. They were then heated to 90°C for 10 minutes to remove the fat. The samples were then filtered with a 1µm filter. **Figure 2** below provide an analysis of the dairy products after removal of fats and proteins.

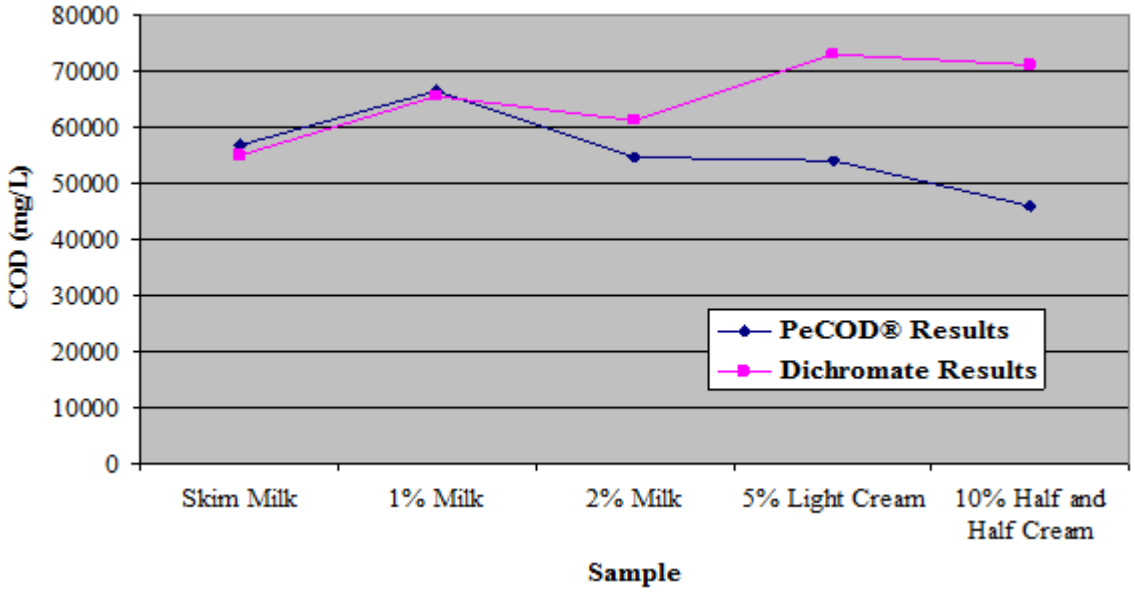

Figure 2: Chemical oxygen demand values obtained for acid and heat treated dairy samples using dichromate analysis and PeCOD® analysis.

Following the acid and heat treatment, the dairy samples containing lower amounts of fat (Skim, 1% and 2% milk) produced PeCOD® and dichromate results that correlated extremely well, with 100% recovery in the skim and 1% milk samples. In fact, for the lower fat samples, acid treatment alone (i.e. no heat) was found to be adequate for complete recovery. Following treatment with acid and heat, recoveries were also greatly improved for the higher fat samples.

The PeCOD® method for COD analysis provides consistent results faster and safer than the dichromate method, which takes 2-3 hours to run and can be a dangerous and costly way to obtain COD information. The PeCOD® requires only an electrolyte solution and calibrant to run and provides accurate and precise results in 15 minutes. It is especially useful for monitoring wastewater to detect product leakage quickly, avoiding any product loss and environmental breaches which can lead to hefty fines.