41b Integrating Engineering Statistical Analysis into the Curriculum: a Hands-on Approach Using Catsup Rheology Measurements

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Engineering statistical data analyses and probabilistic thinking are critical elements of an engineering education. However, chemical engineering curricula often do not include a course in data analysis as departments struggle not to increase the number of credit hours required for an undergraduate degree. One possible solution is to integrate data analysis throughout core courses and electives so that students can learn enough to make optimum use of the material in all of their courses. This involves careful planning on the part of the instructor who needs to teach and implement new concepts in the context of an in-class problem or laboratory experience. This method is most effective when faculty collaborate so that data analysis can be included throughout the curriculum and students are exposed to statistical data analysis techniques several times in different engineering applications. Simple Brookfield viscometer measurements were used to introduce probabilistic thinking and engineering data analysis techniques while investigating the behavior of catsup, a Bingham plastic. Students developed a model for the fluid behavior and obtained the parameters to compute the fluid viscosity as a function of flow conditions. A comparison of the viscosity of two brands of catsup was used to introduce students to engineering statistical differences, the concept of practical vs. statistical differences, and the effect of marketing requirements on technical product specifications. Students were introduced to outlier detection techniques, confidence interval calculations and an overview of analysis of variance. In addition, students were introduced to the importance of measurement uncertainty in any data analysis or comparison. The data analyses were performed using individual group data and data from all of the groups in the class. This approach combined engineering statistical data analysis and rheology directly in a junior level fluid mechanics course. Process Fluids Transport is a second semester required chemical engineering course. This combination allows the flexibility to include more topics in the chemical engineering curricula and to introduce students to industrially relevant and important material. Student responses were positive and the quality of the laboratory reports indicated that students understood the material well.