This work proposes a methodology utilizing functional unfold principal component regression (FUPCR), for application to industrial batch process data as a process modeling and optimization tool. The methodology is applied to an industrial fermentation dataset, containing 30 batches of a production process operating at Novozymes A/S. Following the FUPCR methodology, the final product concentration could be predicted with an average prediction error of 7.4%. Multiple iterations of preprocessing were applied by implementing the methodology to identify the best data handling methods for the model. It is shown that application of functional data analysis and the choice of variance scaling method have the greatest impact on the prediction accuracy. Considering the vast amount of batch process data continuously generated in industry, this methodology can potentially contribute as a tool to identify desirable process operating conditions from complex industrial datasets. © 2016 American Institute of Chemical Engineers AIChE J, 2016