Books on Sustainability

The Future of Glycerol: 2nd Edition

By *Mario Pagliaro* and *Michele Rossi*

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The increasing production of biodiesel by the reaction of transesterification of vegetable oils and fats—mainly with methanol—has led to a glut of cheap glycerol, which has inspired academic and industrial researchers to study many possible valorization pathways for this highly versatile byproduct. Mario Pagliaro and Michele Rossi present in 165 pages not only the most important valorization options for glycerol but also give the various ways of synthesizing this compound. The authors build a bridge from the historical synthesis of glycerol, using potash, to the actual production of biodiesel using heterogeneous catalysts, which releases large quantities of glycerol of a high purity.

Concerning the possible valorizations routes for glycerol, the authors focus mainly on the chemical ones. Nevertheless, one chapter is also dedicated to the direct use of glycerol either as a "green" solvent, as an additive in cement (grinding and waterproofing agent), or even as anticorrosive lubricant.

Among the numerous chemical valorizations published in the literature, the authors especially discuss reforming, selective reduction, halogenation, dehydration, esterification, etherification, and selective oxidation. As all of these reactions lead to more than one single product, the corresponding chapters are divided into sub-chapters according to the target molecule. Furthermore, the authors generally dedicate one sub-paragraph to the commercial and industrial applications, which have significantly increased since the first edition of the book three years ago. This point is clearly of high interest, as it gives concrete data on the maturity of the described processes including the current projects status (research scale, pilot plant, commercial application).

In addition, this economy-related approach finds entrance in the form of a separate chapter at the end of the book, where the sustainability of the glycerol economy is discussed based on fundamental data for production capacities of biodiesel and analysis of the pricing of glycerol.

Whereas these economic aspects are discussed with a lot of detail, the quality and quantity of the sub-chapters describing the synthesis of the target molecules varies. In fact, some reactions (e.g., hydrogenolysis to propylene glycol) are described in-depth including many bibliographic references, but others (e.g., oxydehydration to acrylic acid) are commented with no more than one literature reference. Here, the authors could either have limited the discussion to the most important valorization reactions or could have directly enlarged the scope of their work by deepening the paragraphs dealing with these "minor" reactions.

Compared to the first edition, some new valorization routes have found entrance, such as oxidation using iron catalysts or the two-step synthesis of propane (for application in liquefied petroleum gas) via acrolein as an intermediate. The choice by the authors for specifically describing these new valorization options is not really justified. In fact, a commercial interest for the production of propane from acrolein seems highly doubtful. On the other hand, other reactions to high value products have been ignored.

This book offers a broad scope on the various valorization reactions of glycerol, including non-chemical ones, and the economical aspects are discussed in detail. The book is written in a comprehensive matter so that a reader with fundamental knowledge in chemistry and catalysis can easily understand each subject. Therefore, we primarily recommend this book to managers with a chemical background, but also to scientists who are new in the field of glycerol valorization. Students will also pick up useful information and get a clear view on the glycerol-related economy and glycerol transformations of current interest.

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