As abundant natural products, isoprenoids have many useful industrial applications in the manufacturing of drugs, fragrances, food additives, colorants, rubber and advanced biofuels. The microbial production of isoprenoids has received much attention in recent years. Metabolic engineering approaches and synthetic biology have been utilized to reconstruct and optimize the metabolic pathways for isoprenoid production in cell factories. In this review, the recent advances in isoprenoid production using microbes are summarized, with a focus on MEP and MVA pathway engineering, downstream isoprenoid pathway engineering and microbial host engineering, which mainly includes central carbon pathway engineering. Finally, future perspectives for the improvement of isoprenoid production are discussed.