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[Sample(Articles, Papers)]

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Carbon-titanium dioxide heterogeneous (photo)catalysts (C–TiO_2) for highly efficient visible light photocatalytic application

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ABSTRACT

In this paper, a novel one-step method for the synthesis of a heterogeneous carbon-titanium dioxide (photo) catalyst (C–TiO_2) is first reported. This synthesis method was performed at room temperature and atmospheric pressure using underwater plasma treatment for 15 min over various ratios of titanium and carbon sources. The resulting C-TiO_2 had anatase/brookite polycrystalline phases with turbostratic carbon and large surface areas. The bandgap energies were narrowed by the generation of reactive oxygen species and carbon bonds in the lattice of TiO_2, extending optical absorption into the visible range. C60–TiO_2, which had optimal ratios of carbon and TiO_2, exhibited superior photocatalytic activities for methylene blue ($[k] = 4.61\ h^{-1}$) under artificial solar irradiation due to its enhanced optical properties and numerous adsorption sites, which were approximately 10 times higher than those of commercial TiO_2 ($[k] = 0.41\ h^{-1}$). This study represents a milestone of rapid and convenient methods to produce C–TiO_2 with high photocatalytic performance for environmental applications.

1. Introduction

As industry develops, the threat of environmental pollution is increasing. In particular, organic pollutants cause severe air and water pollution [1]. Numerous attempts to mitigate these organic pollutants have been documented; these attempts have included adsorption, electrical oxidation, and photocatalytic degradation [2–4]. Titanium dioxide (TiO_2) is one of the strongest candidates as a feasible (photo)catalyst because of its various advantages, such as its low cost, nontoxicity, and ability to oxidize organic pollutants [5]. However, TiO_2 suffers from a wide bandgap, low activity under visible light, a high electron-hole recombination rate, and low adsorption ability, and these limitations strongly restrict its application in practical cases [6,7]. Many researchers have attempted to enhance the photocatalytic performance of TiO_2 using various approaches [6,8,9]. For example, TiO_2-based heterogeneous (photo)catalysts, whose microstructures are modulated with external impurities, have attracted increasing attention [10–14]. Among them, TiO_2 (photo)catalysts hybridized with carbon materials effectively enhance organic pollutant removal efficiency without using novel metal species [15]. The high conductivity of carbon materials may provide a path for photoexcited free electrons; therefore, charge-carrier separation occurs [12,14,16]. Additionally, the large surface areas of carbon materials improve the adsorption properties of organic pollutants [17,18]. In addition, hybridizing TiO_2 (photo)catalysts with carbon materials improves their light harvesting properties because white TiO_2 tends to reflect most irradiated light, but gray or black hybridized materials absorb more light in the visible and near-infrared regions [19–23].

TiO_2 (photo)catalysts hybridized with carbon materials are prepared using ultrasound radiation, ion exchange, and adsorption followed by hydrothermal treatment [24–27]. These methods usually require sol-gel processes that consume considerable time and energy [28,29];

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(54) 발명의 명칭 **코로나바이러스 감염증 COVID-19 치료용 펩타이드 및 이의 용도**

(57) 요 약

본 발명은 코로나바이러스 감염증 COVID-19 치료용 펩타이드 및 이의 용도에 관한 것으로서, 기존에 알려진 SARS-CoV의 RBD와 ACE2의 결합부위를 모사하는 펩타이드(P6)에 비해, 본 발명의 펩타이드는 SARS-CoV2 RBD의 새로운 에피토프와의 결합을 더욱 강하게 만들기 위해 아미노산을 구성하는 원자들 사이의 상호작용을 원천적으로 디자인한, 아미노산의 새로운 서열을 추가한 새로운 부분으로 구성되어 있다. 본 발명에서는, RBD와 hACE2 사이의 기존에 알려진 결합 경계면의 후면에 있는 D420, K458의 전하를 띄는(Charged) 아미노산들과 추가적으로 상호작용할 수 있는, 확장된 펩타이드를 독창적으로 디자인하여 기존 알려진 펩타이드 보다 강하게 결합할 수 있는 새로운 디자인의 펩타이드를 제시하였으며, 본 발명의 펩타이드는 향후 COVID-19 치료제로서 높은 가능성을 나타내고 있다.

대 표 도 - 도1