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REVIEW ARTICLE

A bibliometric analysis of research on asphalt aging: trends, patterns, and impact

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Abstract
The aging and deterioration of asphalt binders are critical factors that impact the performance and longevity of the road surface. This bibliometric analysis seeks to comprehensively capture the knowledge gaps and recent developments in asphalt binder aging by identifying the intellectual structure, influence authors, institutions, and emerging themes. The analysis encompasses a wide range of scholarly publications retrieved from Scopus databases, utilizing quantitative analyses through bibliometric indicators and visualizations. Between 2002 and 2022 there were 3166 publications on asphalt aging. The findings illustrate that annual publication is to be expected to increase over the years. The keyword aging was found the most predominant keyword, appearing 626 times, boasting a total link strength of 597, and exhibiting 49 connections to other keywords. Furthermore, bibliometric analysis revealed that researchers are focusing on four important groups, namely performance evaluation methods, additives, application, and mechanisms. It was found that recent research advancements in asphalt aging show promising potential for improving durability and performance, with further studies needed on layered double hydroxide (LDH), styrene–butadiene-styrene (SBS)-modified asphalt, and waste cooking oil (WCO) as a rejuvenator. Additionally, the study explores recent aging simulation techniques, particularly the use of ultraviolet (UV) lamps for simulating photo-oxidation aging, a method still under development. It also emphasizes the need for more accurate aging simulation methods for porous asphalt mixtures, which are more susceptible to environmental factors. This research offers valuable insights that can inspire researchers with new ideas and foster collaboration or involvement in asphalt aging research.

Keywords Asphalt aging · Aging resistance · Aging mechanisms · Bibliometric analysis · Scopus · Reclaimed asphalt pavement · Rejuvenators

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1 Introduction

Asphalt pavements play a crucial role in contemporary transportation infrastructure, facilitating the smooth and secure flow of both individuals and commodities. Central to the performance and longevity of these pavements is the behaviour of asphalt binders, the viscoelastic materials that hold pavement aggregates together. Over time, asphalt binders undergo a complex aging process influenced by various environmental, climatic, and mechanical factors [1]. The asphalt binder in the mixture turns brittle, stiffer, and less elastic due to these characteristics, which increases its vulnerability to rutting, cracking, pits, and exfoliation on the road surface [2]. In this context, replacing the road surface becomes imperative to ensure user comfort, raising concerns about sustainability. Asphalt, being a non-renewable

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