Publication Analysis of the Use of Nonwovens in Landscaping, Building and Road Construction

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ABSTRACT

This paper seeks to predict the increase and possible number of publications about the use of nonwovens in construction for the next 5 years. Based on the overall number of publications in the years 2000 to 2015 about nonwovens in general the percentage of papers about the use of nonwovens in construction in buildings, roads and landscaping is calculated and graphically displayed. Based on the gained data the numbers are then extrapolated to estimate a possible number of publications about the use of nonwovens in landscaping, building and road construction in numbers and percentage in comparison to the overall possible numbers of publications about nonwovens is estimated for the next 5 years.

Keywords: Nonwoven in construction, landscaping, road construction, building construction, publication

Introduction

Through citation analysis it is tried to evaluate the importance, quality and significance of science fields or research topics. In addition the significance of an author´s publication is seek to be evaluated with such method. For this citation reports are created listing the authors and co-authors, title, name of journal, publishing date and year, how often and when it was cited as well as other data. Based on the number of citation of a certain subject the significance of that topic it is then evaluated. This method is discussed in literature regarding if it is a science method or not (Adam, 2002; Garfield, 1979).

In citation analysis the estimation of significance of a topic now and in the future is only based on how often it is cited. It is not considered that basic literature is often cited to introduce a new research topic or describe and new idea or a missed opportunity in another research, or because an article gave some ideas on how to investigate in a complete new topic. It does not necessarily mean that low cited research topics are less significant, scientific or important for modern society.

A citation analysis is not suitable to evaluate the development, importance or significance of a certain research field or topic based on numbers of publications of

articles over a certain time period. This can be done by using a publication analysis.

An ancillary effect of creating citation reports, such as available at the internet database "Web Of Science" (WOS) is also collected data about the amount of scientific articles published each year. Using a citation report, created for citation analysis, a publication analysis can be done. This method is not much discussed in literature (Calero, Buter, Cabello Valdés, & Noyons, 2006) and is a relatively unusual approach to evaluate published literature to estimate increase or decrease in significance of a scientific research topic. With a publication analysis the development of interest in a certain topic over a past period of time can be ascertained and future progress can be estimated.

The objective of this paper is to evaluate the number of publications about nonwoven in building, road and landscape construction and how it will increase in the future based on data gained through citation analysis available at WOS.

Approach

By taking the initial steps for a citation analysis the software available at WOS was used to gather data about publication and a progression model was used to evaluate the progress of publications about nonwovens in construction over the last 15 years (2000-2015) with outlook in number of publication for the next 5 years (2016-2020). The groups of construction were limited to the use of nonwovens in landscaping, textiles in building construction and road work.

In first step a search engine was chosen to search for certain search terms. After going through different advanced search instruction videos and demonstrations for various databases, such as EBSCOhost (EBSCOhost, 2016) or Engineering Village (Engineering Village, 2016), as well as reading search instructions for them, the search engine that seems suitable most for the purpose of the research was Advanced Search tool at WOS. Even the WOS search engine searches through available sources, such as journal articles, books, book chapters, reviews and Abstract of Published Items, a citation report is only available for journal articles.

In next step search terms where defined. Based on the topic - the use of nonwovens in construction - three different kinds of construction where defined, which are building construction, road construction and landscaping.

Nonwovens in landscaping are geotextiles such as drainages or web layers for preventing erosion in creating or securing landscapes. In building construction (Lin et al., 2011), nonwoven are used in fiber or textile reinforced concrete. Glass fiber mats for insulation as well as other mat structures where not include in the search. In road construction layers of webs are used to form adhesive and form stabilizing layer under or in asphalt layer (Correia & Bueno, 2011). Use of nonwovens for interior use were not considered therefore they are used for decoration and not for direct construction or reinforcement in a structure. For each query related to the defined topics search terms where defined to correlate to the main search term, such as different expressions, names or spelling, as some examples listed in Table 1. During the first search runs, new discovered terms where implemented to ensure a proper coverage of search areas.

Table 1. Sub search terms for main search terms. X mark the combination in a query (*indicates plural and derivations such as pave*ment, pave*ing).

	Building construction	Landscaping	Road construction
Nonwoven*/non-woven*	X	X	X
Construction	X		X
Geotextile*		X	X
Landscape*		X	
Erosion		X	
Concrete	X		
Asphalt			X
Reinforce*	X		X
Pave*			X
Fiber*/fibre*	X	X	X
Insulation	X		

After the search terms where define, field tags were chosen to comb through. Field tags are operator for the query which defines the field of search, such as AD for Address, AU for Author, PY for Year Published or IS for ISSN or ISBN. For this research the tags TI for Title and TS for Topic where chosen. TI-field tag only searches in the title of a record, whereas TS-field tag searches in Title, Abstract, Author Keywords and Keywords Plus® (WOS, 2009). To avoid missing records through typos in the title or missing search terms in the abstract or keywords, the field tag TI was included in all queries.

The search options where set to the years 2000 till 2015, all languages and all document types without any exclusion of certain research fields or journals.

Table 2. Two examples of one sentence queries.

TS=(nonwoven* OR "non woven*") OR TI=(nonwoven* OR "non woven*") AND TS=(Geotextile*) OR TI =(Geotextile*) AND TS=(landscape*) OR TI=(landscape*) AND TS=(erosion) OR TI=(erosion)
TS=(nonwoven* OR "non woven*") OR TI=(nonwoven* OR "non woven*") AND TS=(Construction*) OR TI =(Construction*) AND TS=(Concrete) OR TI =(Concrete) AND TS=("Building construction*" OR "Housing construction*") OR TI=("Building construction*" OR "Housing construction*") OR TS=(nonwoven* OR "non woven*") OR TI=(nonwoven* OR "non woven*") AND TS=(Construction*) OR TI =(Construction*) AND TS=(Concrete) OR TI =(Concrete) AND TS=(fiber*) OR TI=(fiber*) AND TS=(reinforce*) OR TI=(reinforce*)

Each search term in each query is connected through a Booleans which are operating terms for a systems algebraic notation to connect search terms logically with true or false, such as AND, OR, NOT, SAME or NEAR (WOS, 2009). They tell the system how two or more key words have to be connected and interpreted in the search. For example using AND as and Booleans it means the system has to list all results that uses both key words in the connected field tag. NEAR can be used for address researches to search in a geographical area. According to the instruction and demonstration videos on how to use the advanced search setting at WOS queries where formed and executed. While combining all possible search terms, with given Booleans in one or two queries at once as shown in Table 2, the number of results decreased to an extent that the data where too limited to use.

To get more data, several queries, as shown in Table 3 with more data range, where made and the gained data combined.

The citation analysis provided by WOS was used to create and download citation reports. To avoid unrelated publication to the search tags, the results where scanned manually and unrelated articles, where removed. For example the queries for "nonwoven" and "road" where combined, resulting in articles listed, discussing the use of nonwoven in road construction (Luo et al., 2013) as well as articles using a regression model for analyzing sound absorbency coefficient of nonwovens (Liu, Bao, Shi, Zuo, & Gao, 2014). It was listed based on the mentioning of noise created by traffic on big roads. Articles like this include all search terms, but not in the context relevant for this research. For each query the citation report in excel form was downloaded. Gained reports from related topics then where combined and double or triple records where deleted, so each reference only occurs once in the data set. Next the list where sorted with the sorting function provided by the excel tools. The number of publications for each year then where counted manually.

The limitation for using the tool at WOS is that there are only approximately 7500+ primarily English-language journals available for text mining tool and citation report. Further publications in books, conferences, dissertation & theses as well as patens and technical reports are not included for citation reports and analysis. Also publications from some research fields might not be available at WOS.

Table 3. Single search term queries.

#1	TS=(nonwoven* OR "non woven*") OR TI=(nonwoven* OR "non woven*")
#2	TS=(Geotextile*) OR TI =(Geotextile*)
#3	TS=(landscape*) OR TI=(landscape*)
#4	TS=("Building construction*" OR "Housing construction*") OR TI=("Building construction*"OR "Housing construction*")
#5	TS=(Housing) OR TI=(Housing)
#6	TS=(Construction*) OR TI =(Construction*)
#7	TS=(Building*) OR TI =(Building*)
#8	TS=(Concrete) OR TI =(Concrete)

Results and Discussion

As it can be seen in the graphs in Figure 1 to Figure 4 the number of publications about nonwovens in general increase in average from 2000 till 2015 by 426% from about 143 publications in 2000 up to 610 publications in 2015 (Figure 1). It also can be seen the peak of publications was reach in 2014 after a constant increase over the past 14 years, except in 2002.

The numbers of publications about the use of nonwovens in building construction (Figure 2 in the WOS over the years are constantly low and does not exceed more than 9 in 2014.

This behavior is also visible in the number of publications about nonwoven in use of road construction as shown in Figure 4. This might be to the selected search terms, which does not include "mats", such as glass wool, therefore the results did not meet requirements for this paper´s research. There are probably more literature about the use of nonwovens in roads and buildings, but not published in literature available at WOS. Literature about those research fields may be published in journal regarding construction or are company internal studies and classified reports. Another possibility is that different or scientific vocabulary is used to describe research about building and road construction that is no known to the author.

Available publications in WOS about nonwovens in landscaping (Figure 3) in contrary are much higher with an irregular distribution over the years. In average 6% of publications about nonwovens are about

nonwovens and landscaping, such as drainages or erosions prevention.

Therefore no limitations in article´s language where defined, sources from all over the world are included. Based on the extensive width of source distribution research about the reasons that caused different peaks such as in Nonwoven in 2002, Building construction in 2014, Landscaping in 2006 and 2008 or Roads in 2013 where not undertaken.
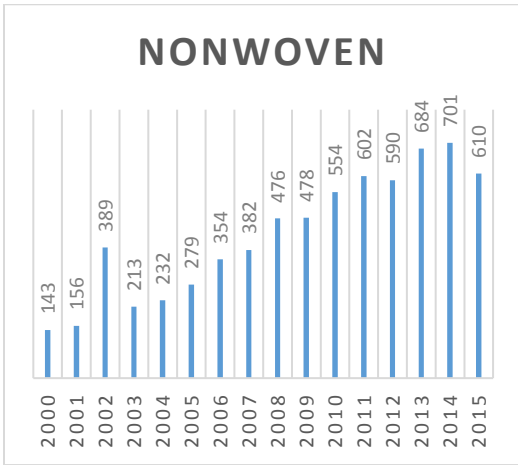
Therefore no limitations in article´s language where defined, sources from all over the world are included. Based on the extensive width of source distribution research about the reasons that caused different peaks such as in Nonwoven in 2002, Building construction in 2014, Landscaping in 2006 and 2008 or Roads in 2013 where not undertaken.

NONWOVEN

Figure 1. Number of publications for nonwovens in the years 2000 till 2015.

BUILDING

Figure 2. Number of publications for the use of nonwovens in building construction in the years 2000 till 2015.

LANDSCAPE

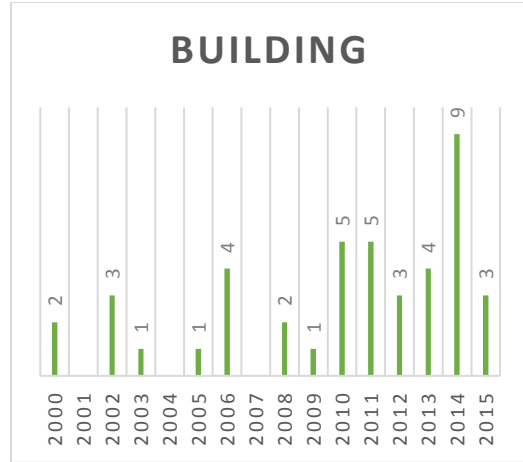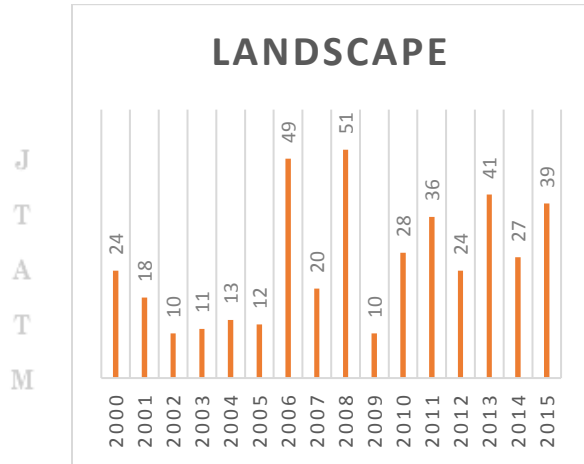**Figure 3. Number of publications for the use of nonwovens in landscaping in the years 2000 till 2015.**
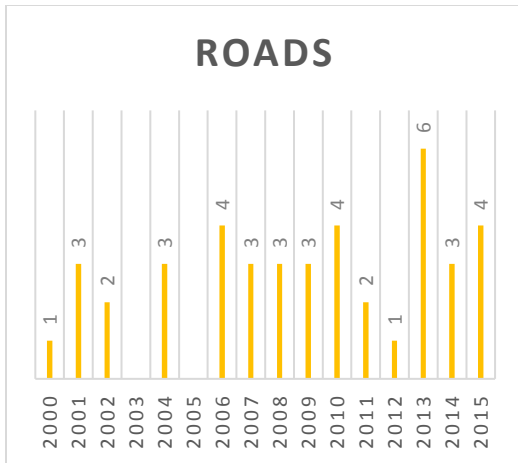
Figure 4. Number of publications for the use of nonwovens in road construction in the years 2000 till 2015.

Prediction and conclusion

Based on the created data set exponential extrapolation (see Equation (1) was used to calculate future numbers of publications for nonwoven in different construction areas.

$$y = a_1 * e^{a_2 x} \qquad (1)$$

As shown in Figure 5 to Figure 8, a constant upward trend for each research area is expected. Using Equation 1, the number of publication available in WOS about nonwovens in the year 2020 will be reaching approximately 1440 publications per year (Figure 5).

From this about 50 publication (Figure 7) will be done in research area about using nonwovens in landscaping. Approximately 4 publications about nonwovens in 2020 available at the web of science will be about the use of nonwovens in road construction (see Figure 8). 7 publications will be about the use of nonwoven in building construction (Figure 6). The increase in road and building construction will be probably more, but literature will not necessarily be available at WOS database.
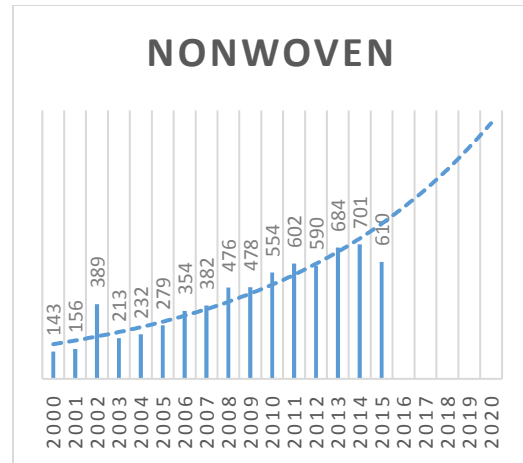

Figure 5. Extrapolated data for publications about nonwoven for the years 2016 till 2020.
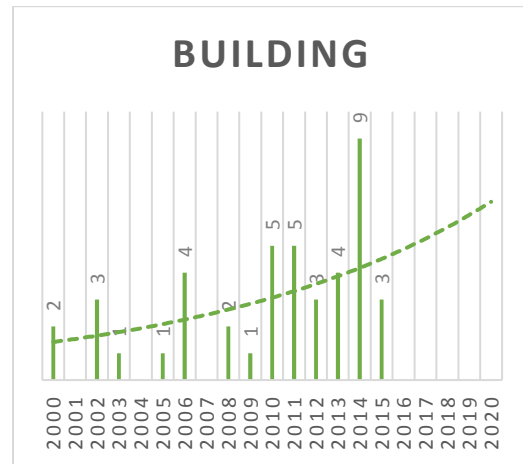

Figure 6. Extrapolated data for publications about nonwoven used in building construction for the years 2016 till 2020.

As it can be seen in Figure 5 to Figure 8, the increase in number of publications in the general field of nonwoven is much higher than those in the other fields. The differences can come from more increasing number of publications in a different field of research, such as medical products, filtration or interior products. Further it has to be noted that possible new research fields can be established in the coming years, which might further increase the publication of the use in nonwoven in general.
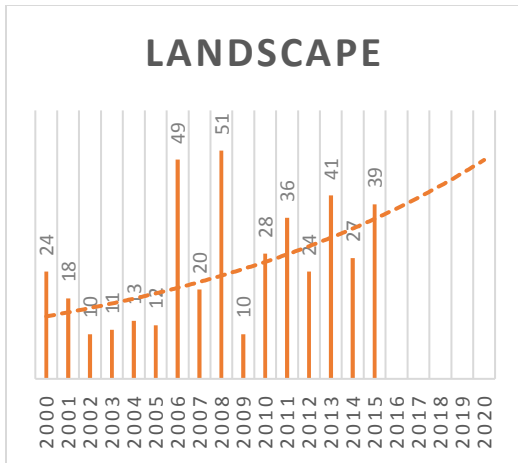
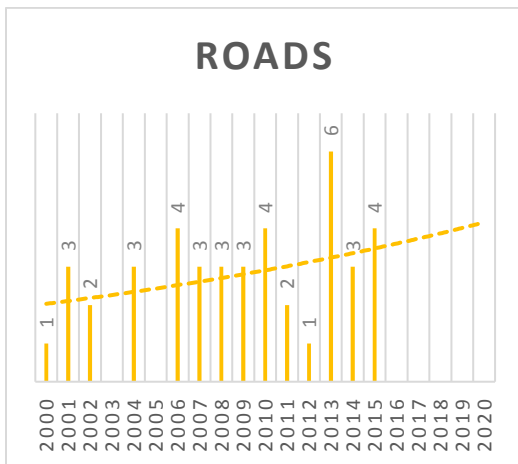**Figure 7. Extrapolated data for publications about nonwoven used in landscaping for the years 2016 till 2020.**

Figure 8. Extrapolated data for publications about nonwoven used in road construction for the years 2016 till 2020.

Based on shown results it becomes clear that the interest in nonwovens and its performance increased in the last 15 years and will also further increase. Therefor in WOS only journal articles are available for citation report, data in books or conference reviews or other sources were not included. Still it is estimated that the number of publications each year in each of the investigated fields will increase or stay constant, but will not decline.

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