The Frequency of Various Parts of Speech in Chosen Technical Research Papers

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ABSTRAKT

Bakalářská práce se zabývá studiem slovních druhů a jejich frekvencí ve vybraných odborných anglických článcích z oblastí technologie. Cílem teoretické části je popis slovních druhů obecně a v akademickém psaní. V práci je obecně charakterizován Britský národní korpus. Praktická část obsahuje analýzu vlastního korpusu. Ta porovnává frekvenci slovních druhů v celém korpusu, v článcích z vybraných technických oborů a v technických článcích vydaných v určitých letech. Výsledky analýzy jsou porovnány s výsledky analýzy informativního psaní v Britském národním korpusu.

Klíčová slova: analýza korpusu, slovní druhy, frekvence slovních druhů, Britský národní korpus

ABSTRACT

The bachelor thesis deals with the study of parts of speech and their frequency in chosen technical research papers. The aim of the theoretical part is a description of parts of speech in general and academic writing. The British National Corpus is generally characterised. The practical part contains the analysis of its own corpus. The analysis compares the frequency of parts of speech in the whole corpus, in chosen technical research fields and in the years of publishing of the technical articles. The results of the analysis are compared with the results of the analysis of informative writing in British National Corpus.

Keywords: corpus analysis, parts of speech, frequency of parts of speech, British National Corpus

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INTRODUCTION

In the field of corpus linguistics there is a wide range of research articles focused on different corpus analysis, for instance: The most frequent phrasal verbs in English language EU documents – A corpus-based analysis and its implications, A corpus-based local context analysis for spoken dialogues. I have not found a corpus analysis of the frequency of various parts of speech in technical research papers and this is the reason I have chosen this topic for my bachelor thesis.

My bachelor thesis is divided into two parts. The theoretical part deals with the main facts about parts of speech in general and academic writing. I described parts of speech in general and academic writing because my topic is about the frequency of parts of speech in chosen technical research papers. At the end, I focused on the British National Corpus because I will use this corpus for a comparison with the analysed one. The practical part of the thesis is based on a corpus analysis of collected articles from the fields of Food and Polymer Technology.

The aim of the analysis is to show the frequency of parts of speech and then to compare the results with informative writing from the British National Corpus. The results of the analysis are illustrated by charts to demonstrate the diversity of frequency in different years of publishing. These charts indicate the comparison between academic and informative writing and also describe the frequency of nouns and verbs.

I. THEORY

1 PARTS OF SPEECH

"The part of speech is a category to which a word is assigned in accordance with its syntactic functions" (Oxford University Press 2013). The context is needed when the part of speech is being determined. If the context is missing then it is hard to distinguish the given part of speech. The example below shows the difference between noun and adjective and how this difference is defined by context.

- *"…and described these three zones for the flow of parallel plane jets."*
- *"A proper frame of reference is needed to correlate data from various flow rates and flow geometries."*

There are four criteria for establishing parts of speech:

- Semantic meaning is based on the meaning of words
- Morphological meaning is based on the word-structure
- Syntactic meaning determines the grammatical function of word-order
- Phonetic meaning considers criteria regarding, for example some specific phoneme or a particular stress pattern (Huddlestone, Pullum, and Bauer 2002, 21-22)

Parts of speech can be divided into two groups: open class categories and closed class categories. Open class categories have an unlimited number of items and form new items. Included in this category are nouns, adjectives, verbs, adverbs and prepositions. Closed class categories, on the other hand, have a limited number of items and do not form any new items. Belonging to this category group are pronouns, particles, conjunction, numerals, determiners, interjections and modals (Quirk and Greenbaum 1990, 192).

Open and closed class categories of parts of speech are the same for both general English and academic English. The difference, however, is that the vocabulary used in academic English differs from that used in general English. Moreover, there is the possibility that some words may have different meanings. As McCarthy and O'Dell (McCarthy and O'Dell 2008) show in their example, the meaning can be specialised. The example shows the different meanings of the verb *underline* between general English and academic English.

- *"Underline your family name on the form".*

  This means that one should draw a line under it.
- *"The research underlines the importance of international trade agreements".*

In this example it means that the word *underlines* is giving emphasis to something. (McCarthy and O'Dell 2008, 10)

As the title indicates, academic writing is in a formal style because the authors use specific words with specific meaning. On the other hand, Cutts (Cutts 2007) says that if documents are carefully written in plain English, it is more likely to enhance the reader's understanding.

1.1 Nouns

Nouns denote particular persons, places, objects and things and can be either countable or uncountable. Countable nouns are things that can be counted – for example: *car*. Here there can be one, two, three or more cars. The indefinite or definite article *a/an/the* must be used with singular countable nouns (*I have an idea* or *The collection was very expensive*). Uncountable nouns refer to liquids, powders, materials, food, days and abstract items which cannot be divided into separate elements and therefore not be counted. For example: *milk*. Litres of milk can be counted but one cannot count milk itself. Despite the countable and uncountable noun division, Quirk, Greenbaum, Leech and Svartik (Quirk, Greenbaum, Leech and Svartik 1985) indicate some instances in the English language where uncountable nouns can also be used as countable. Examples: *There is evidence that…* and *a piece of evidence*; show that the first underlined noun *evidence* is uncountable and the second underlined noun is countable. In contrast with technical writing, Swales and Feak (Swales and Feak 2001) demonstrate that some nouns which are uncountable in everyday English may occur as countable in technical English. Nouns have a range of functions; they can stand as a subject, direct object, object of preposition, object complement or subject complement (Gaetz and Phadke 2009, 358).

On the other hand, more formal nouns are used in academic writing to express a certain point which is involved in the study of the text. Some general nouns are used to express the writer's ideas or to describe a particular point.

- *"She wrote an article on the subject of class."*

  Here the subject is meant as the main point of the article which is being researched (McCarthy and O'Dell 2008, 12).

Important features of nouns are number, gender, case, countability and definiteness can be determined. Only these categories can be determined with uncountable nouns: number, countability and definiteness.

The category of **number** involves singular and plural. Singular indicates only one object (*book*). Plural indicates more than one object and usually requires the ending *-(e)s* (*books*). Some nouns create plurals with the change of a vowel (*man – men*). The form of singular and plural can also be identical (*sheep*). Because of pronunciation, some singular nouns form these plurals (*knife – knives*).

An important feature is **gender**, which is more semantic than grammatical. This category is used to determine whether the noun is masculine (male human beings and animals), feminine (female human beings and animals) or neuter (inanimate things and animals whose gender is unknown).

The **case** is a certain form of a noun which generally has some endings added to a word. Nouns have two forms of cases. Common case (Jack) and genitive/possessive case (*Jack's*). This category involves word-order. Verb and preposition are the case assignors (Bieber 1999, 234-236).

Definiteness in English deals with the use of articles which are connected with countable nouns. The location of determiners is on the left edge of a noun phrase. Up to three determiners can be added to one noun phrase (*both those two important articles*). Concerning countable nouns, there are three options – the definite article *the*, the indefinite article *a/an* and the zero article.

- The definite article – indicates that the noun is familiar to the listener and it says that the speaker has already mentioned it before. Singular nouns always have the same form and definite article and do not change (*the article*). On the other hand, plural nouns change only their form but the definite article is the same (*the articles*).
- The indefinite article – says that the speaker is mentioning a certain noun for the first time. The form *an* is used in front of words which begin with a vowel sound (there are some cases where the form *an* is used when the word is spelled with a consonant – *hour*). The indefinite article is used only for singular nouns. Plural nouns or uncountable nouns have the zero article. Nevertheless, Swales and Feak (Swales and Feak 2001) state that the indefinite article cannot be used with names of theories, devices and other specific names; the definite article must therefore be applied for such instances (*The Hubble telescope*).
- The zero article – is the absence of an article. The zero article is used with plural nouns. Swales and Feak (Swales and Feak 2001) indicate that the zero article is

used with a proper name in possessive form (Archimedes' law) (Quirk and Greenbaum 1990, 192-193).

1.2 Adjectives

Adjectives are words which modify nouns. If one looks at a certain word in isolation, it is hard to recognise whether it is an adjective or not. They work as pre-modifying words and can either pre-modify a noun or be pre-modified with the word *very*. The function of adjectives is to achieve the expression of feelings, qualities, etc. Furthermore, as Gaetz and Phadke (Gaetz and Phadke 2009) show, adjectives can be placed after a linking verb (*be, smell, become*). Adjectives do not express number, case, gender and person and in English, can be gradable and non-gradable. Gradable adjectives can vary in grade or intensity (*cold, very cold, extremely cold*), whereas non-gradable adjectives cannot vary in grade or intensity because they are either extreme (*boiling*) or absolute (*dead*). One cannot be *very dead* (Quirk, Greenbaum, Leech and Svartik 1985, 399-403).

Adjectives also differ in academic texts. They differ from general texts in which they involve normal adjectives (*beautiful, handsome lovely*, etc.). Such adjectives are avoided since they are not considered formal and are therefore unsuitable for academic writing. Whereas the adjectives mentioned above are considered out of place in academic English, adjectives such as *significant, environmental, theoretical* and *variable, etc.* are considered very formal, specific and therefore appropriate for academic writing (McCarthy and O'Dell 2008, 16).

Grading is an important feature of adjectives, but only applies to gradable adjectives. There are two grades – comparative and superlative. When a comparative is being created it involves adding ***–er*** to the root adjective. When creating a superlative ***(the) –est*** (*quick, quicker, the quickest*) is applied. This is called synthetic form. On the other hand, analytic forms are created by adding ***more*** for comparative and ***(the) most*** for superlative (*important, more important, the most important*). In addition there is a third form – irregular. Irregular words change their structure (*bad, worse, the worst*) (Quirk and Greenbaum 1990, 139).

1.3 Pronouns

Pronouns are specific parts of speech in a sentence and represent nouns or adjectives and adverbs. They do not carry lexical meaning. According to the situation and the context in

which they are applied, refer to different people or objects – e.g. *The file cannot be downloaded. – It cannot be downloaded.* Pronouns are divided into several groups with a fixed number of members – for instance, personal (*I, me, you, we, us …*), possessive (*my, mine, our, ours …*), demonstrative (*this, these, that, those*) and others. The usage in general English is widespread and it is not restricted (Quirk, Greenbaum, Leech and Svartik 1985, 333-335).

On the other hand, some pronouns are not very frequently used in academic writing. Particularly personal pronouns do not occur in academic texts very frequently. If the writer wants to be professional, he or she should not use the personal pronoun *I*. The usage of the personal pronoun *I* is not considered formal in academic writing since it indicates that the writer is trying to catch the attention of the reader and take the reader away from the idea of the text. Additionally, the use of the first person singular pronoun suggests that the work is not objectively written. When the writer is not using the personal pronoun *I*, the reader is focusing more on the main point of the article. In addition, demonstrative pronouns are used quite often. They are used for the description of things that were previously mentioned in the text before (Oshima and Hogue 1997, 92).

There are four grammatical categories – case, person, number and gender. Pronouns have three distinct **case** forms – *1. Subject case* (*I, we, he …*) *2. Object case* (*me, us, him …*) *3. Genitive/ Possessive case* (*my, our, his …*). Pronouns act in subject case as the subject of a clause. In object case, the function is the recipient or the object of a preposition. The possessive case represents possession of something.

Unlike nouns pronouns have distinction of **person**. This stands for personal, possessive and reflexive pronouns. Speaker(s)/writer(s) are included in the reference of 1st person pronouns. Speaker(s)/writer(s) are not included in the 2nd person pronouns. Only the addressee(s) is included. Speaker(s)/writer(s) and addressee(s) are not included in the 3rd person pronouns because they refer to the third parties.

The feature of **gender** is restricted only to 3rd person singular pronouns of these categories – personal, possessive and reflexive pronouns. Plural distinctions as *they, them* are neutralised in the gender distinction. The distinction between personal and non-personal gender is based on whether it is a "person" that is referred to. The sex of the person is the main source how to determine the masculine and feminine pronouns (*Bob found himself in troubles with his results. Bobby found herself in troubles with her results.*) (Quirk and Greenbaum 1990, 108-128).

On the other hand, in academic writing it is recommended that sexist pronouns be avoided since the usage of these pronouns does not give the text high value when the writer does not know the target reader (*If one wants to become a writer, he has to learn basics in writing. – If one wants to become a writer, he or she has to learn basics in writing.*) (Gaetz and Phadke 2009, 368).

1.4 Verbs

Verbs together with subjects are necessary for building a sentence. On a basic level, they indicate what the subject does or is. Usage of clear and lively verbs for the expression of action is important because it gives power to writing. Verbs are words which describe an action (*write, read*) or state of being (*exist, grow*). In contrast to other parts of speech, they differ in their ability to change form. This stands for almost all verbs. The verb phrase is built with one or more verb elements, and, according to their function in the verb phrase, can be divided into three categories – open class of lexical verbs (also known as full verbs), closed class of primary verbs and modal auxiliary verbs. Verbs have tense, mood and voice. The purpose of tense is to indicate the point in time at which the current situation is happening. Voice, on the other hand, explains whether the subject is doing an action or the action is carried out on the subject. (Quirk and Greenbaum 1990, 24-28)

Usage of verbs in academic English differs from the usage in general English. Specific verbs are in use and help to express in detail the research or the point which is being proven. Specific verbs function to provide, analyse, consider, determine, show and distinguish, etc. These specific verbs help the writer to substitute other verbs which have already occurred in the text. Changing the description verb rather than repeating the same verb over and over is essential in academic writing for the purpose of variety. For instance, the verb *provide* is more formal and is more appropriate in an academic text than the verb *give*, which has the same meaning but is not as formal. Verbs are also combined with noun form (*This research provides a description of frequency of parts of speech*). The *underline* verb and noun form show that specific verb as *describe* can change to specific noun as *description*. When the author is writing an academic text, he or she uses a single verb where it is possible because it shows formality of the text (McCarthy and O'Dell 2008, 14). Swales and Feak (Swales and Feak 2001) state that contractions should be avoided to preserve a formal style of academic writing. (*The analysis didn't support the main idea. – The analysis did not support the main idea*).

These grammatical categories can be determined – tense, aspect, mood and voice. **Tense** is a grammatical category which refers to time – past (before action), present (now) and future (after action). The feature of **aspect** indicates complementation, beginning, repetition or duration of the action and there are two aspects – progressive and perfective. The grammatical category of **mood** expresses the writers view on the action. There are three types of mood – indicative, imperative and subjunctive. The category of **voice** deals with distinction between active (*decide*) and passive voice (*was decided*) (Quirk, Greenbaum, Leech and Svartik 1985, 149, 155, 158).

The usage of passive voice in academic writing is high because it makes the text formal (Gaetz and Phadke 2009, 338).

1.4.1 Full verbs

Full verbs have their own meaning and can be categorised into two types – regular verbs and irregular verbs. As previously mentioned, they change in morphological form. There are five forms – base form, *-s* form, *-ing* participle, past form and *-ed* participle. Regular verbs have four morphological forms (*want, wants, wanting, wanted*). This, however, is not the same with irregular verbs. Some can have five forms, whereas others, only three. It depends on the specific word (*fly, flies, flying, flew, flown – cut, cuts, cutting, cut, cut*) (Quirk, Greenbaum, Leech and Svartik 1985, 159-160).

1.4.2 Primary verbs

Three verbs belong in this category – *be, have* and *do*. They have two functions: they either can act as the main verb or, as an auxiliary. The verb *be* is very unique in English because it has eight different forms. They can also be used as main verbs unlike modal auxiliaries.

1.4.3 Modal auxiliaries

They are used with another verb in order to indicate mood. Their function is to express necessity, ability or permission. Modal verbs include – *can, could, may, might, shall, should, must, ought, will* and *would*. In addition, they do not have *-s* form,*-ing* participle and *-ed* participle. Therefore it is not possible to inflect them in the 3rd person singular. Every modal verb is followed by a main verb (Swan 2005, 258).

1.5 Determiners

Determiners are parts of speech which closely describe the noun and determine whether the noun is specific or general. Determiners can also identify the quantity. There are three categories – pre-determiners (*all*), central determiners (*a/an*) and post-determiners (*few*) (Biber 1999, 670; Quirk, Greenbaum, Leech and Svartik 1985, 253).

As Gaetz and Phadke (Gaetz and Phadke 2009) say, the usage of some determiners can be confusing for non-native English speakers. Problems commonly encountered by non-native English speakers include articles (*a/an/the*), post-determiners (*many, few…*) and demonstrative determiners (*this, that, these, those*). Consequently, it is often recommended that non-native speakers have their writing checked by a native speaker, specifically for grammatical accuracy.

1.6 Adverbs

The function of an adverb is to modify. The modification can be done for adjectives, adverbs, nouns, determiners, pronouns, verbs and even whole sentences (it appears at the beginning of a sentence). By adding an adverb, information can be provided about time (y*esterday*), manner (*quickly*), frequency (*always*) or place (*everywhere*). From the point of morphology, it is possible to distinguish three types – simple adverbs (*only, down, near …*), some of which provide information on position and direction, compound adverbs (*somehow, therefore, hereby …*) and derivational adverbs (*strongly, sideways …*). Derivational adverbs are created by derivation – adding the suffix -*ly*. However, there are some exceptions with not so common words and suffixes (*sideways, clockwise*) (Quirk, Greenbaum, Leech and Svartik 1985, 399-453).

There are specific adverbs which are used more in academic writing than in general English. These adverbs (*inconsistently, functionally, evidently …*) are very specific and do not occur very often in everyday communication. Usage of these specific adverbs depends on the topic of the text and they are not used in every sentence. They are only used when it is necessary and when the writer needs modification in the text (Gaetz and Phadke 2009, 379).

1.7 Prepositions

The main function of prepositions is to express a certain relationship. They link one word to another part of a sentence. There are three options regarding the ways in which

prepositions can work in a sentence. If they occur in front of a noun phrase they create a prepositional phrase. They can stand as a post modifier, adverbial or complement. Prepositions can be divided into two groups – simple prepositions and complex prepositions. If they consist of one word, this means that they are simple prepositions (*for, like, out, on, ...*) and if they consist of more than one word this means that they are complex prepositions (*apart from, instead of, according to, ...*). Prepositions can show a comparison (*as ... as*), possession (*of*), purpose (*for*), source (*from*), direction (*towards*) and time (*before*) (Biber 1999, 576-621).

Prepositions also frequently occur in academic writing. They associate with verbs, nouns, adjectives (*on the other hand, search for, benefit from, common to ...*) and this is why they are very frequent in academic writing. This is very useful for the writer because, as mentioned above, the style of academic writing is very formal and these prepositions help the text to be more credible and professional. The usage of the prepositions depends on the writer and on his or her skills to use the correct adverbs and make the text more formal (McCarthy and O'Dell 2008, 34).

1.8 Conjunctions

Rather clumsy. Suggest: During the construction of a sentence, conjunctions are used to connect words, phrases and clauses. If they stand alone they express no independent meaning. They help the text flow. Conjunctions have three main categories – coordinating, subordinating and correlative conjunctions. Coordinating conjunctions link or join mostly two phrases or words together, but they do not depend on each other and they do not give themselves meaning; for instance – *and, but, for, or ...* (*…intercept with respect to either inlet velocity or outer die diameter.*) On the other hand, subordinating conjunctions join a main clause which stands by itself and a dependent clause which cannot stand by itself. The dependent clause alone would not make any sense. The position where the conjunctions are placed in this case is before the dependent clause, but the dependent clause by itself can be either in front of or following the main clause. Belonging to this category are – *since, because, as, before, until ...* (*Since the effect of N on the size of features significantly outweighs the effect of V*). In the last category belong correlative conjunctions, which work in pairs; their task being to join words or groups of words together in a particular sentence. Some of the correlative conjunctions are – *either/or, both/and, just as/so ...* (*It was*

expected that the morphology would be either hexagonally packed cylinders or body-centred cubic spheres) (Quirk and Greenbaum 1990, 224-233).

Oshima and Hogue (Oshima and Hogue 1997) say that conjunctions are located in every academic text. They serve as connectors of nouns, verbs and sentences. The most frequent conjunctions (*and, or, but, for …*) are used both in academic writing and general English. The writers have to pay attention to which conjunction they want to use because if they choose a wrong conjunction, the entire meaning of the sentence can be altered. (*The lake of erythrosine is not permitted since concerns over its iodine content. – The lake of erythrosine is not permitted because of concerns over its iodine content.*)

2 FREQUENCY OF PARTS OF SPEECH IN BRITISH NATIONAL CORPUS

The frequency of words used in the British National Corpus (BNC) will be introduced in this part. For the thesis the author has chosen the parts of speech frequency of informative texts in the British National Corpus for comparison with the analysis of his corpus.

A corpus can be classified as a large collection of texts that are collected in electronic form. There are four criteria for building a corpus – authentic, electronic, large, and specific. When a text is in electronic form it means that it is stored on a computer and can be processed by it. Because of these four criteria the corpus is different from other texts. It is not a collection of random texts. A corpus is a collection of texts which are chosen on specific criteria to build a representative corpus of particular texts and it is a very useful analytical tool. It helps to break down the whole into pieces (words) so that they can be studied individually. When the corpus is in the stage of preparation, it is essential to bear in mind what goal is trying to be achieved. If the target is to analyse the pharmaceutical field, then a lot of articles involved in this topic will be collected (Bowker and Pearson 2002, 10).

BNC is a very large collection of texts which consists of more than 4,000 different text files. The files are composed of written and spoken English. The BNC corpus has five sections which are divided into more subsections. There are subsections which deal with word frequency in the whole corpus. Then there is a section which involves comparison between spoken/written texts, only spoken and only written. The last part deals with grammatical word class. The speech texts had to be transcribed first before becoming part of the corpus. The identification of parts of speech is done automatically by a specific program. 134 parts of speech are distinguished in this corpus. It is very detailed and very precise. For instance, twenty-two subclasses of noun are distinguished in the whole corpus (Leech, Rayson and Wilson 2001, 1-4).

II. ANALYSIS

3 THE FREQUENCY OF PARTS OF SPEECH IN TECHNICAL RESEARCH PAPERS

The main aim of this analysis is to identify the frequency of parts of speech in journal articles from two different technical fields – Polymers and Food Technology. The analysis will be done using corpus. The aim of this analysis is to compare the results with the frequency of parts of speech in the British National Corpus (BNC), which deals with texts in general English. The frequency of informative writing in BNC was chosen for the comparison.

3.1 Corpus preparation

This analysis will focus on technical English in the field of technology. Since the term "technical" is very general, it was firstly necessary to decide which subject would be the field of focus for the construction of the corpus.The term "technical" needed to be specified. As mentioned above, it was decided to examine polymers and food technology because these fields are studied at Tomas Bata University in Zlín, at the Faculty of Technology.

These two fields are very interesting from the linguistic point of view. Technical language is the main element for Polymers and Food Technology. This is why it will be suitable for the analysis of frequency in technical articles. After finding suitable research fields, it was important to find scientific journals which are focused on these issues. The library search engine XERXES was used for the searching of the journals. A decision was made that three different scientific journals would be used for the analysis. Other key points for the research were time and authors. The corpus was built from different articles which were published in different years and written by different authors, but under the one condition that the authors were native speakers of English. Articles from these journals were used: for polymers - Journal of Polymer Science Part A: Polymer Chemistry, Journal of Applied Polymer Science, Polymer International and for food technology - International Journal of Food Science & Technology, Food Service Technology and Journal of Food Science.

Before the articles were chosen, it was important to decide on the structure and on the length of the articles. The structure was Introduction, Materials and Methods, Results and Discussion, Conclusions. The length of the articles had to be the same so that the analysis could show valuable results. Although it was decided that the maximal length would be 18

pages per article, some articles had fewer pages in one year. Consequently, another article had to be picked from the same year but from a different journal. Also, some articles had pictures and figures included, and this meant that particular articles had more pages. Because of this, it was important to go through the articles to establish whether they had similar lengths of text. This was done because the results would be different in each year if the articles did not have the same length. Based on this rule, the articles were picked from the journals. Therefore, the selection was limited and the results had to be interpreted with limits.

It was decided that from each journal, five articles from different years of publishing would be chosen. The total amount of collected articles was 30. The following magazines, years of publishing and articles were chosen:

Journal of Polymer Science Part A: Polymer Chemistry – 1997 (Synthesis and Spinning of a Thermotropic Liquid Crystal Copolyester Containing a Semirigid Cycloaliphatic Spacer), 2004 (Initiator Efficiency of 2,2 -Azobis(isobutyronitrile) in Bulk Dodecyl Acrylate Free-Radical Polymerizations over a Wide Conversion and Molecular Weight Range), 2008 (Syntheses, Characterization, and Functionalization of Poly(ester amide)s with Pendant Amine Functional Groups), 2010 (Disassembly via an Environmentally Friendly and Efficient Fluorous Phase Constructed with Dendritic Architectures), 2013 (Synthesis and Thin-Film Orientation of Poly(styrene-blocktrimethylsilylisoprene));

Journal of Applied Polymer Science – 1996 (Injection Molding of Polypropylene Reinforced with Short Jute Fibers), 1999 (Aerobic Mineralization of Paperboard Materials Used in Packaging Applications), 2004 (Analysis of Isothermal Annular Jets: Comparison of Computational Fluid Dynamics and Experimental Data), 2008 (Thermal Degradation Analysis of Thermoset Resins), 2013 (The Effects of Neutralization on the Dynamic Rheology of Polyelectrolyte Microgel Mucilages);

Polymer International – 1996 (Multiple Dielectric Relaxation Processes in an Unequilibrated Bisphenol-A Polycarbonate), 2001 (Thermal and mechanical characterization of epoxy resins toughened using preformed particles), 2005 (Rubber composites reinforced by soy spent flakes), 2009 (Cure characterization of the ring-opening metathesis polymerization of linseed oil-based thermosetting resins), 2012 (pH-responsive hydrogels with dispersed hydrophobic nanoparticles for the delivery of hydrophobic therapeutic agents);

International Journal of Food Science & Technology – 2000 (Colouring our foods in the last and next millennium), 2003 (Physical and sensory characteristics of sugar cookies containing mixtures of wheat, fonio (Digitaria exilis) and cowpea (Vigna unguiculata) flours), 2007 (Original article Initial evaluation of a field-friendly extraction procedure for the enzymatic assay of cassava cyanogens), 2010 (Original article Dynamics of water in agar gels studied using low and high resolution 1H NMR spectroscopy), 2013 (Original article Process development for spray drying a value-added extract from aflatoxin-contaminated peanut meal);

Food Service Technology – 2001 (Effect of cooking method and variety on the sensory quality of rice), 2002 (Effectiveness of cleaning methodologies used for removal of physical, chemical and microbiological residues from produce), 2003 (Evaluation of a multisite food service information system), 2004 (Prevention of food worker transmission of foodborne pathogens: risk assessment and evaluation of effective hygiene intervention strategies), 2005 (Food hygiene training in the UK: a time for change);

Journal of Food Science – 1997 (Reduction of Fluid Loss from Grapefruit Segments with Wax Microemulsion Coatings), 2002 (Pasteurization of Fresh Orange Juice Using Gamma Irradiation: Microbiological, Flavor, and Sensory Analyses), 2007 (Release of 1-Methylcyclopropene from Heat-Pressed Polymer Films), 2010 (Formation of Calcium-Mediated Junction Zones at the Onset of the Sol-Gel Transition of Commercial κ-Carrageenan Solutions), 2013 (Inactivation of Vibrio parahaemolyticus in Hard Clams (Mercanaria mercanaria) by High Hydrostatic Pressure (HHP) and the Effect of HHP on the Physical Characteristics of Hard Clam Meat).

The articles were downloaded from online libraries to which our university has access. The articles were in Portable Document Format (PDF) and it was necessary to convert them to plain text file because the programs used for the analysis supported only text files. The program Oxford Wordsmith Tools 4.0 was used for the analysis of the corpus because it was developed and designed for working with corpora. Basically, this tool divides the whole text into individual words and then the text can be examined in terms of frequency, clusters or patterns of a particular word that user chooses.

The text was inserted into the program which counted the frequency of every word in the text. Then the author had to divide the words into specific parts of speech in order to count them. The frequency of parts of speech was counted manually because the program

cannot recognise different parts of speech. When the frequency was counted, the results were put in the spread sheet and charts were created based on these results.

3.2 Corpus analysis

Firstly, it is important to stress that the corpus was limited and therefore the results should be viewed in consideration of this. It is also necessary to say that the analysis is focused on the following parts of speech – nouns, adjectives, pronouns, verbs, adverbs, prepositions and conjunctions. Determiners and particles are not included in the results.

Further on, it will be shown how the frequency occurs in the two technical fields and how it differs according to the year of publishing. Also, the results will be compared with the frequency of parts of speech in informative writing in the BNC corpus. It is necessary to mention that the results could not be used for further research because the frequency of BNC is per one million words and the frequency in this corpus is per 175 thousand words. The frequency of BNC had to be recalculated to the frequency per 175 thousand in order for the results to be compared together; this is why the results have to be taken with limits. The analysis was divided into two parts to show the contrast between frequency in Polymers and Food Technology. The frequency in the Polymers Technology corpus is per 86 thousand words and the frequency in the Food Technology corpus is per 89 thousand words. The frequency had to be recalculated for comparison with BNC on the frequency of Polymers and Food Technology corpora.

3.2.1 Overall analysis

Figure 1 shows the statistics of the whole corpus. The frequency of parts of speech is illustrated below, covering relevant parts of speech. The whole corpus deals with texts published from 1996 to 2013. The number of words used in this corpus is 175 thousand. Some of the texts dealing with Polymers and Food Technology do not occur in the same year because it was not possible to obtain articles from the same year. This is why there are higher values when looking at particular years.

From Figure 1 it can be seen that the most frequent parts of speech are nouns. This is given with the style of academic writing because it uses a lot of nouns because of description of certain methods which are used in the articles. Also very frequent are verbs and conjunctions. On the other hand, adverbs have the lowest frequency. They are not used very often because they are not necessary for technical writing. They do not need to be used because these texts are focused on research which does not require a lot of modifying

adverbs. It only requires facts to support the research. As the figure shows, adjectives and pronouns are also not so commonly used. This is because the analysed samples are journal articles which focus on the description of certain facts.

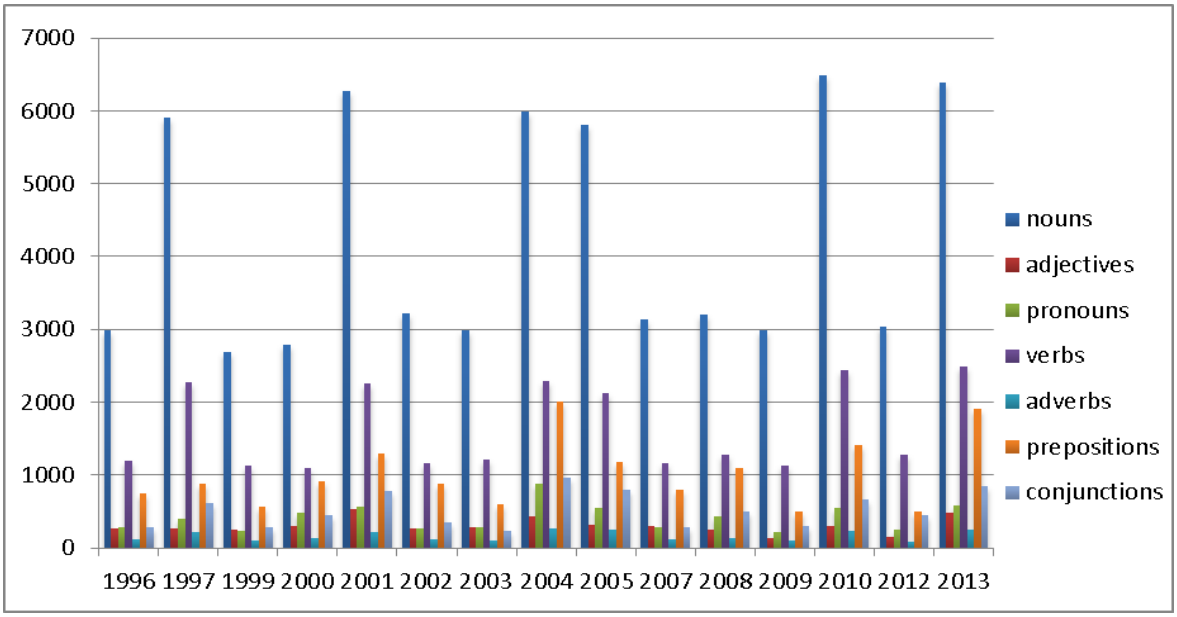

Figure 1 – Frequency of parts of speech in the analysed corpus

Figure 2 represents frequency in the whole corpus compared with the frequency of informative writing in the BNC corpus. With the reduced number of frequency in BNC, the difference is significant, particularly with regard to nouns. It shows that adjectives, pronouns, verbs, prepositions and conjunctions have a slightly higher frequency than in BNC. However, adverbs are more frequent in BNC than in technical writing. These results have to be taken with caution.

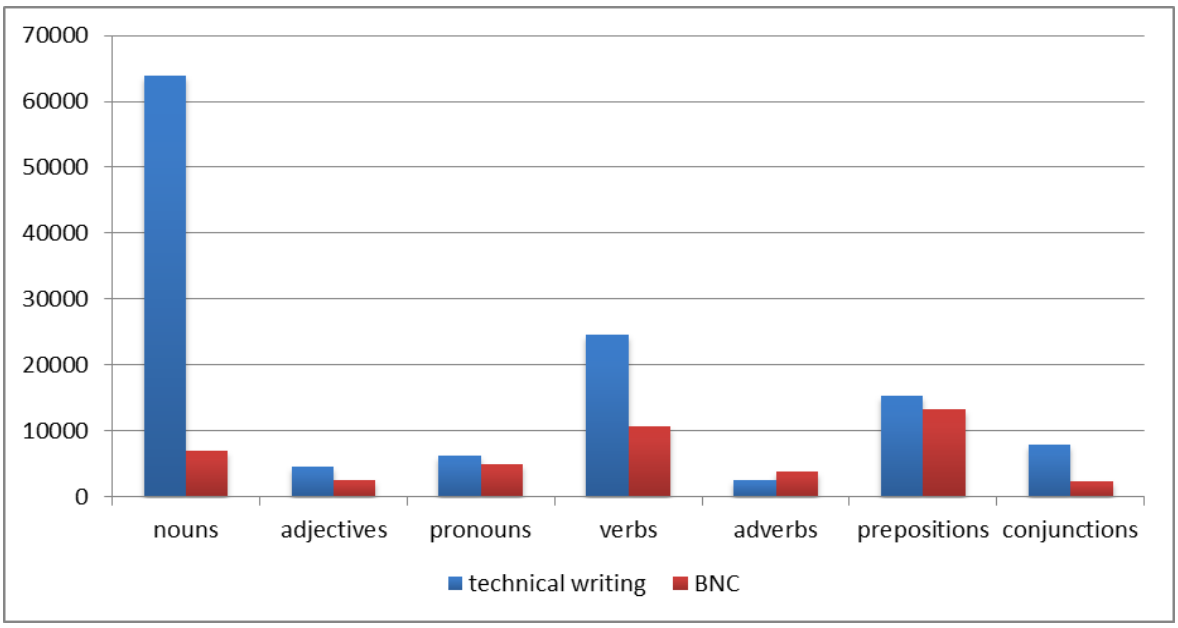

Figure 2 – Frequency of parts of speech in the analysed corpus in comparison with BNC

3.2.2 Food Technology corpus

Figure 3 demonstrates the frequency in the field of Food technology. As the values demonstrate, the frequency does not differ very much. However, some texts have more prepositions, whereas others have more conjunctions; it depends on the structure of the text and on the author. It is the authors that have the power to determine frequency and it is their job to write in detail but not to overuse modifying words. Their arguments must be strong enough to support their research. As a result, adverbs are not so commonly used in this field because they are not required to prove the writers' point. As the figure shows, adverbs have the same frequency in the Food Technology as in the Polymers Technology corpus. Prepositions are used to connect word and phrases and allow the possibility to contruct more complex sentences, thus aiding the author in expressing facts. Looking at Figure 3 from the point of time there is no clear trend in the frequency.

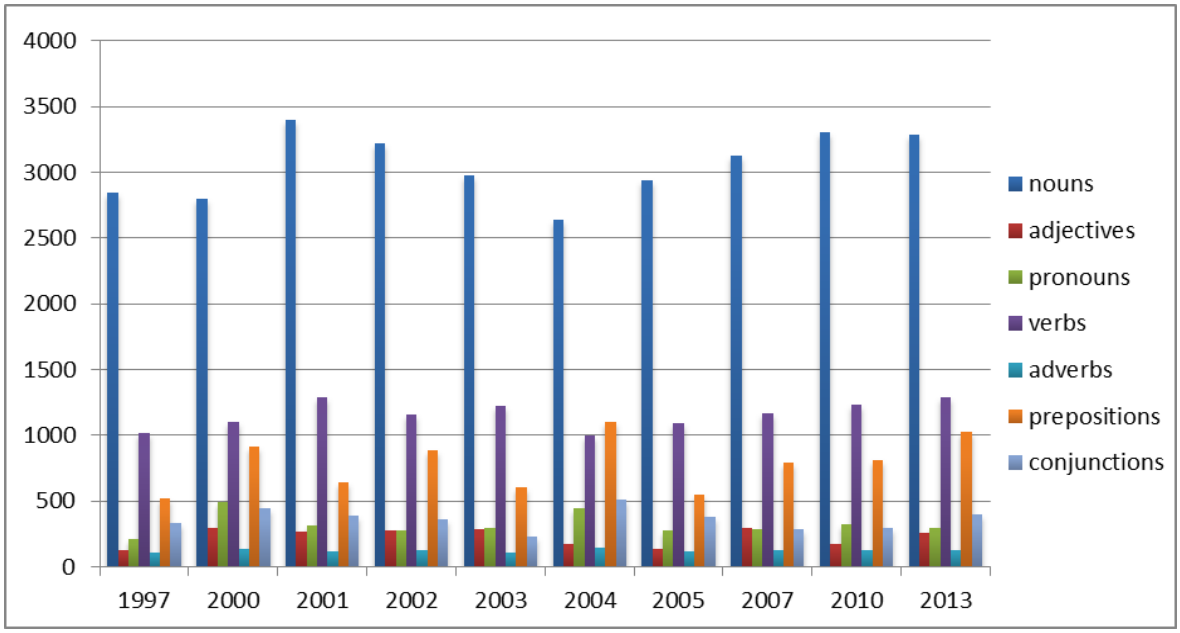

Figure 3 – Frequency of parts of speech in Food technology

Figure 4 represents the frequency of parts of speech in the Food Technology corpus and in the BNC corpus. The frequency is slightly higher in adjectives, pronouns and prepositions. The frequency of nouns is higher in the technical writing because more nouns are required for description. Additionally, nouns are more repeated in order to describe certain research. Also, the frequency of verbs is higher in Foot Technology corpus. This might be given by the reduction of BNC. Adverbs are more frequent in the BNC corpus than in the analysed corpus. The results have to be considered with limits.

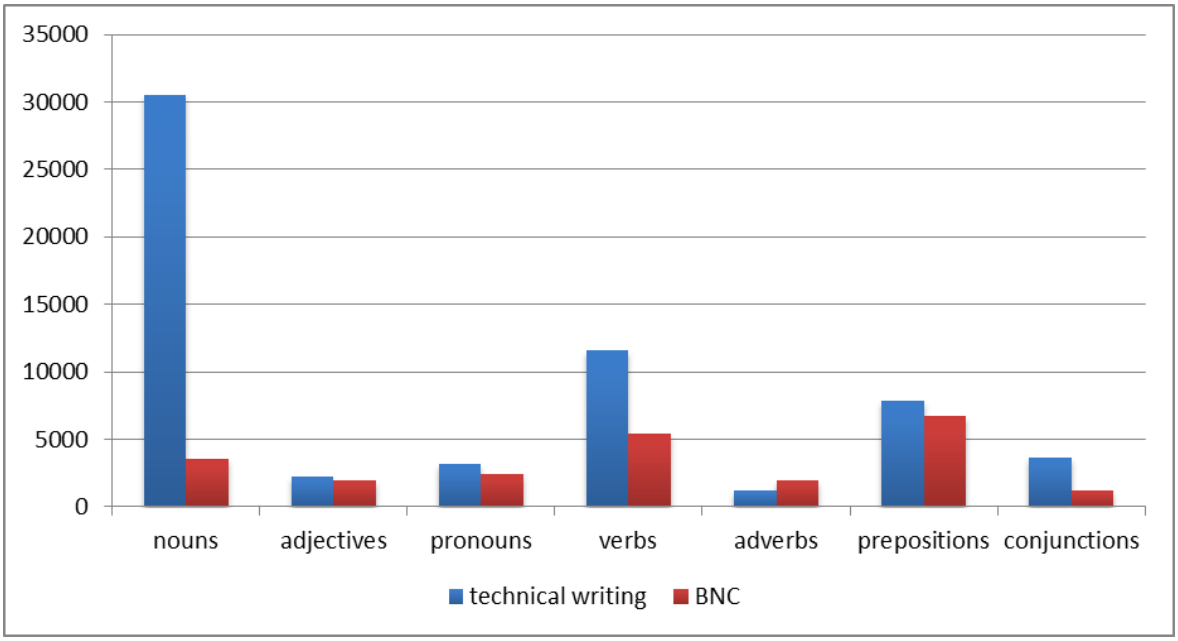

Figure 4 - Frequency of parts of speech in Food Technology in comparison with BNC

3.2.3 Polymers Technology corpus

Figure 5 deals with the frequency of parts of speech in Polymers Technology. This field has a similiar frequency as Food Technology because the total number of words is more or less the same. When the author was comparing the frequency in both fields, it became apparent that writing in technical English does not differ much. The articles have a lot of similarities. The authors probably do not know this but they are writing different texts on different topics and their style of writing is close to being identical. Nevertheless, there are some distinctions that can be made. For instance, the usage of pronouns in texts of Food Technology is higher than in Polymers Technology. Other differences might occur in the text, such as lower frequency of prepositions or conjunctions. As far as nouns are concerned, many specific nouns are used because of the technical language on which the text is focused. Thus, it depends on the writer which vocabulary will be used for the writing of the text and only he or she can influence the frequency.

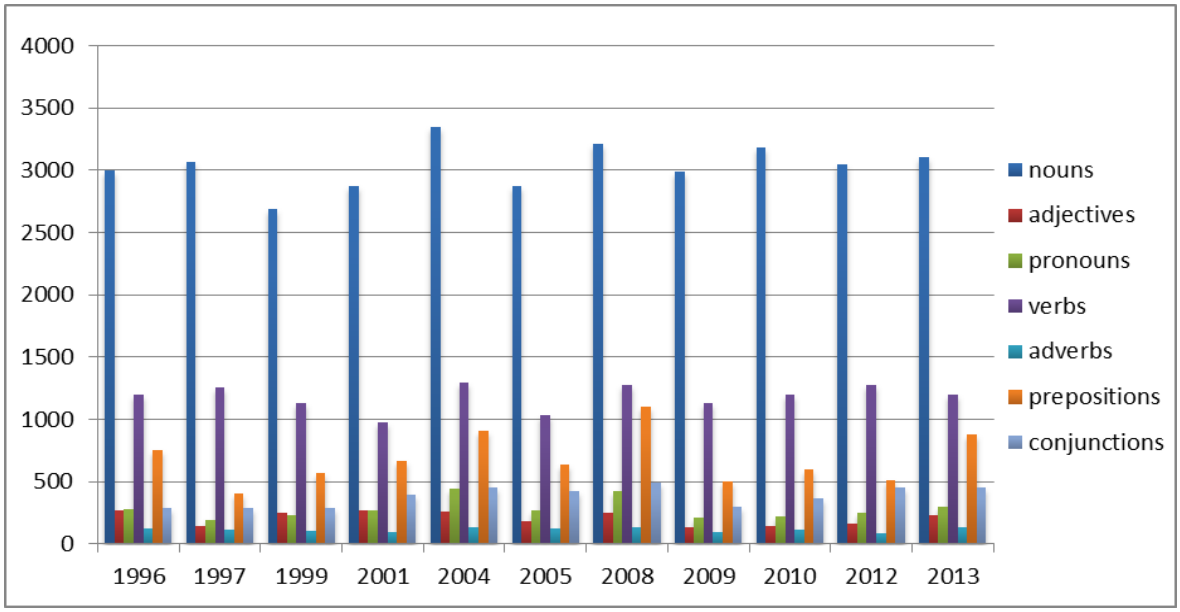

Figure 5 – Frequency of adjectives in Polymers

Figure 6 describes the frequency in the Polymers Technology corpus and in the BNC corpus. The figure compares technical writing and informative writing. It is noticeable that this comparison is similar to the one in Figure 4 because the total number of words used for the Polymers and Food technology corpora differs by 3 thousand words. Only the frequency of adverbs is higher in the BNC corpus. The frequency of other parts of speech is higher in the BNC corpus. The results of this comparison have to be taken objectively.

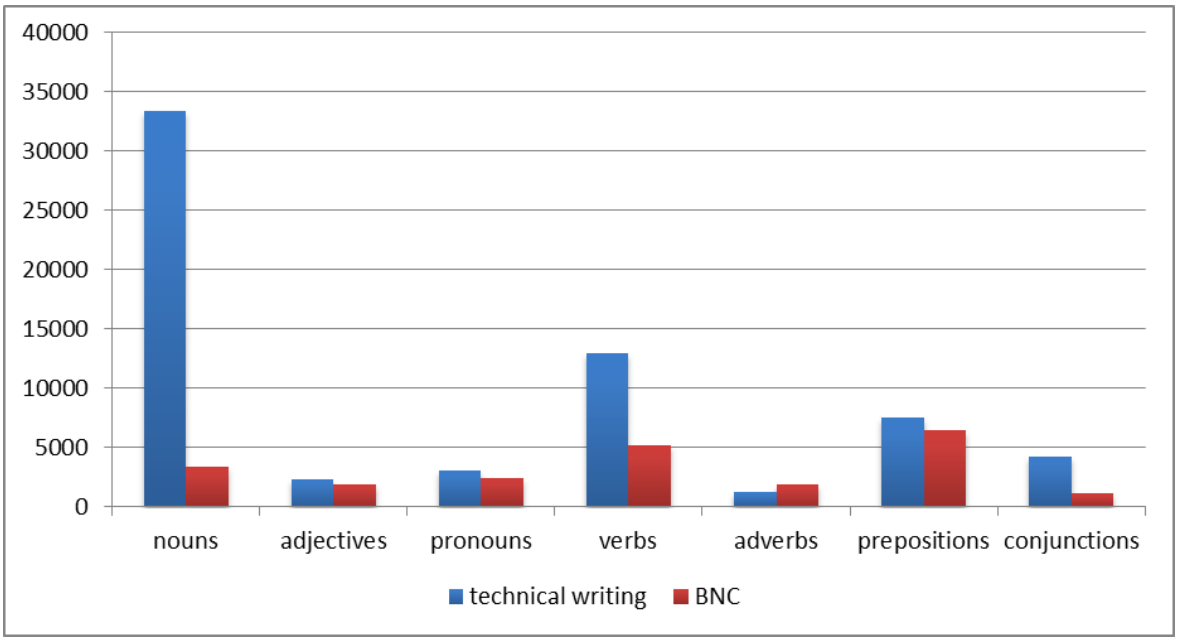

Figure 6 - Frequency of parts of speech in Food Technology in comparison with BNC

Further on, we are going to pay attention to nouns and verbs in detail. It was decided that they would be compared with the BNC corpus to show the difference between the

frequency in technical writing and in informative writing. The adjectives, pronouns, adverbs, prepositions and conjunctions will be mentioned only in general and the analysed figures are in the appendix.

3.2.4 Nouns

The files which were used still have a high frequency; either specialised nouns which are part of technical English or nouns that are used in everyday communication.

As Figure 7 indicates the most frequent is the word *water* because it is located in the field of Food Technology which often uses this word for the description of certain processes that are described in the articles. The year of publishing does not show that this word is influenced by time and it also depends on the topic on which the text is focused on. The next word which occurs in this figure more frequently is the word *study*. This word is quite frequent in this field because the research in Food Technology articles is based on studies. Other words are not so frequent because they differ in time and also in the topic they are focused on. For instance, the word *water* is very frequent in the year 2010 because it might be used in text which was focused on specific research. When we want to compare the years of publishing, Figure 7 shows that the frequency of depict nouns is increasing from 2001, but in 1997 and 2000 the frequency is very low.

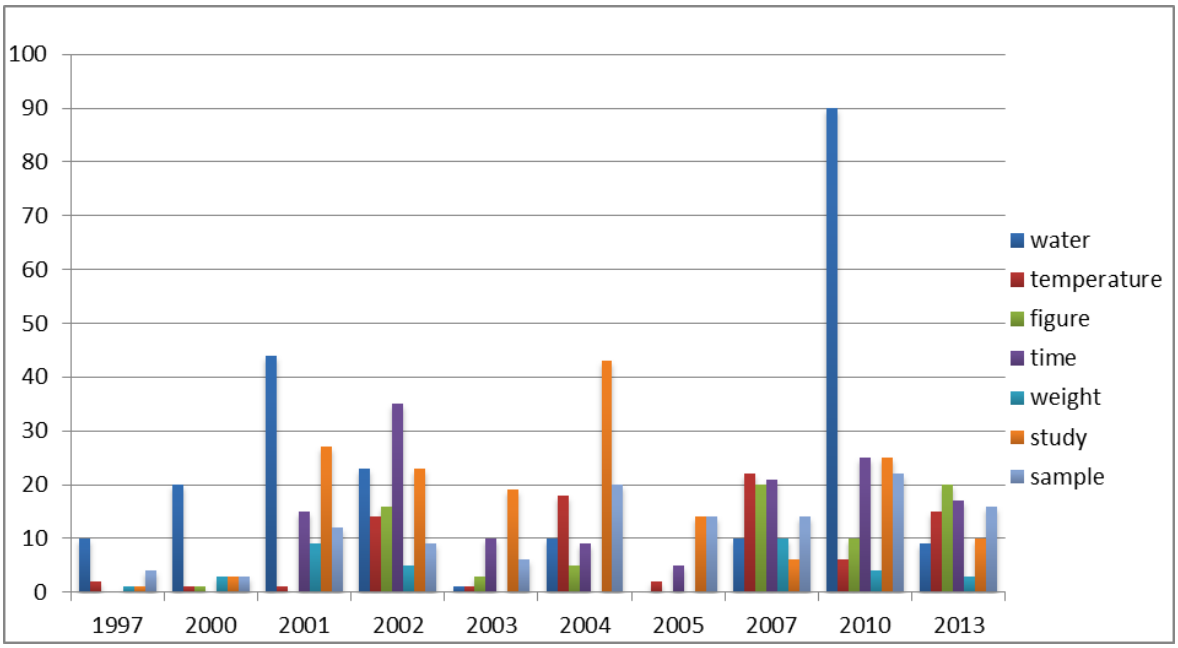

Figure 7 – Frequency nouns in Food Technology

Figure 8 describes a comparison of frequency of nouns in Food Technology and in the BNC corpus. It is important to say that words *temperature, weight and sample* were not part of the BNC corpus. The frequency of words *water* and *study* is quite similar. As the

figure shows the frequency of depicted nouns is higher in informative writing than in technical writing. In Figure 8 is visible that the frequency of the noun *time* is very high and the results from BNC could not be compared with the small corpus of Food Technology; that is why the results are limited for further comparison.

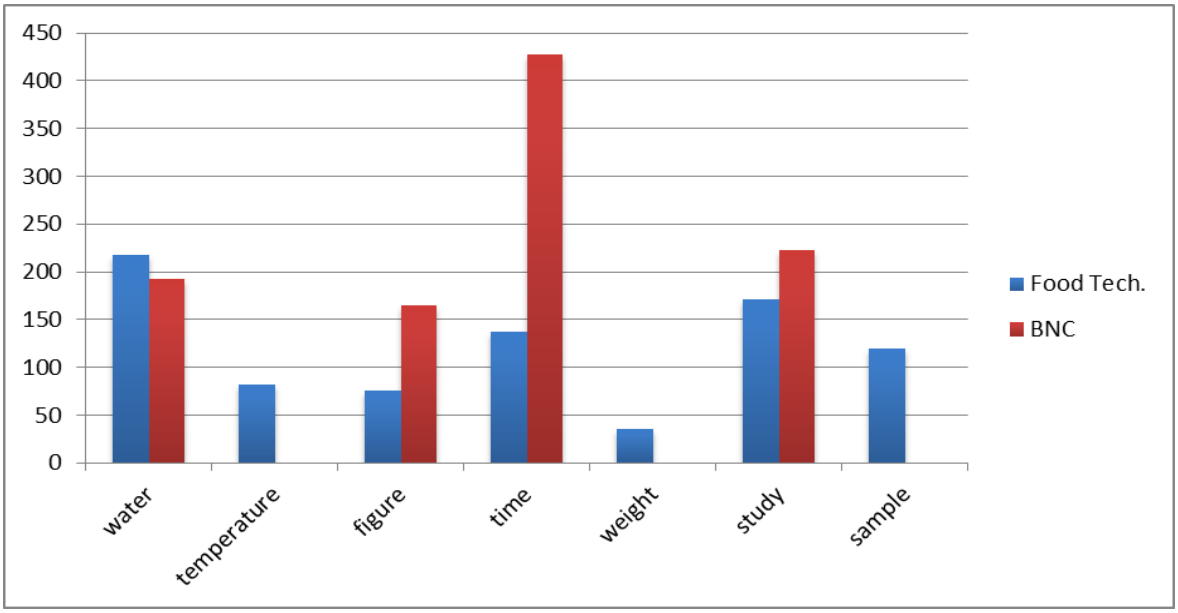

Figure 8 – Frequency of nouns in Food Technology and in BNC

Figure 9 displays the frequency of nouns in the field of Polymers Technology. The frequency of nouns is more significant here. As the figure shows the words *temperature*, *figure* and *weight* are very frequent. This might be caused by the authors because they are involving more words which are based on the similar topic and research. The word *figure* indicates that in certain texts the main ideas are displayed with figures. Regarding the year of publishing, the frequency is various but the word *figure* occurs in almost every year because figures help to demonstrate ideas. The next word *sample* is located in every year because in this field it is used in the articles to show a sample of a substance which is described.

Comparing figures 7 and 9, it is apparent that the most frequent nouns do not have the same frequency in two different specialised fields. In fact, as Figure 1 shows, the frequency of nouns is similar in the entire corpus. While looking at the figures from the point of time, it shows that the displayed words are more frequent in Polymers Technology since 1996 and the frequency is more or less the same. In Food Technology, however, the frequency of words from 2001 is starting to become similar in value.

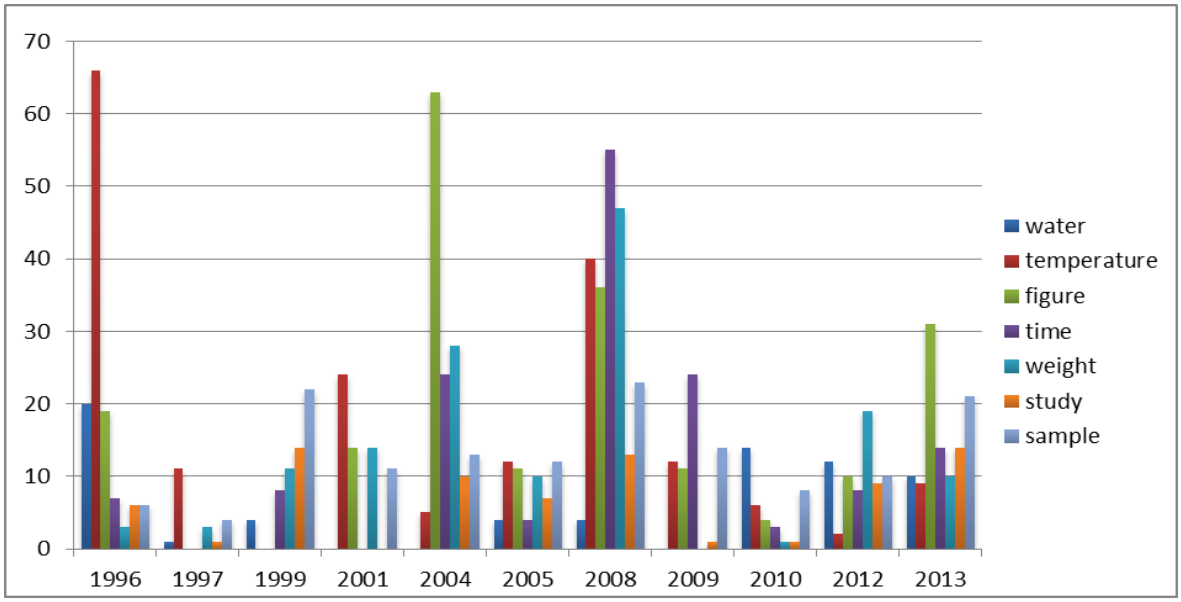

Figure 9 – Frequency of nouns in Polymers Technology

Figure 10 indicates the frequency in the two corpora. It is important to notice that the words *temperature, weight* and *sample* are not part of the BNC corpus and that is why they could not be part of the comparison. The frequency of the nouns *water, time* and *study* in the BNC corpus is higher than in the field of Polymers Technology. On the other hand, the frequency of the noun *figure* is higher in technical writing than in informative writing. This might be caused by the writer because he or she is using figures to support his or her ideas. Because we used a small sample, the reader has to bear in mind that these results have to be viewed in consideration of this limitation.

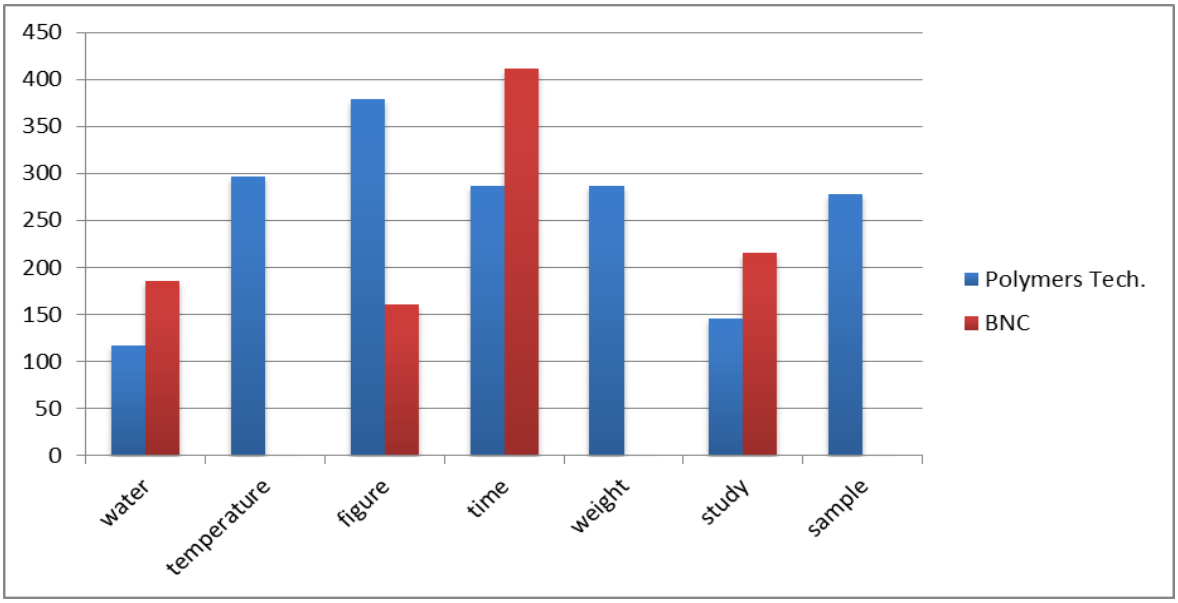

Figure 10 - Frequency of nouns in Polymers Technology and in BNC

3.2.5 Verbs

Verbs are necessary to build a sentence and this is why the frequency is very high in the whole corpus. There are a lot of verbs that were used but some of them are more frequent than others.

Figures 11 and 13 show the most frequent verbs in the analysed corpus. It is important to stress that verbs *is, was, were* and *be* are one verb but in different forms. It was decided that these forms of verb *be* would show the usage in time and the diversity in both fields of technology. These verbs are used to build sentences in different tenses, mostly in past tense. Figure 11 indicates that in the year 1997 the frequency of these verbs in Food Technology is not so common, but in the following years the usage of these verbs is rising. Therefore, it indicates the development in time and it might be caused by a new trend in writing. The most frequent words are the verbs *is, was* and *were*. As the figure below shows, these verbs occur very frequently in every year. The usage of the verbs *was* and *were* differs a little, but the total amount of verbs used in the texts is almost identical. In fact, this is given with the style of technical writing. The usage of the passive voice is very frequent because the style requires it in order to show the formality in technical writing.

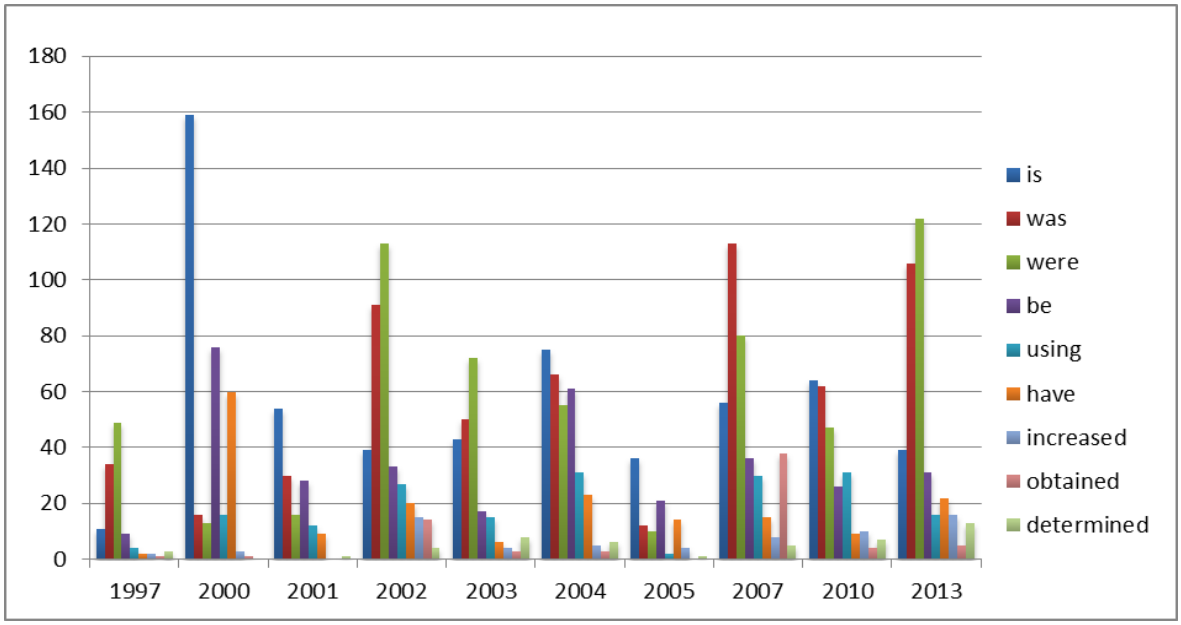

Figure 11 - Frequency of verbs in Food Technology

Figure 12 represents the frequency comparison of verbs in Food Technology and in BNC. Although the frequency in BNC was reduced, it still has higher frequency of verbs than in Food Technology. It is necessary to say that the verbs *obtained* and *determined* were not found in the BNC corpus. It shows that the usage of verbs like *is, was, were, be* is also high in informative writing. This is caused by the usage of different tenses. It cannot

be compared on this small sample but at least it shows some similarities of the usage of some verbs.

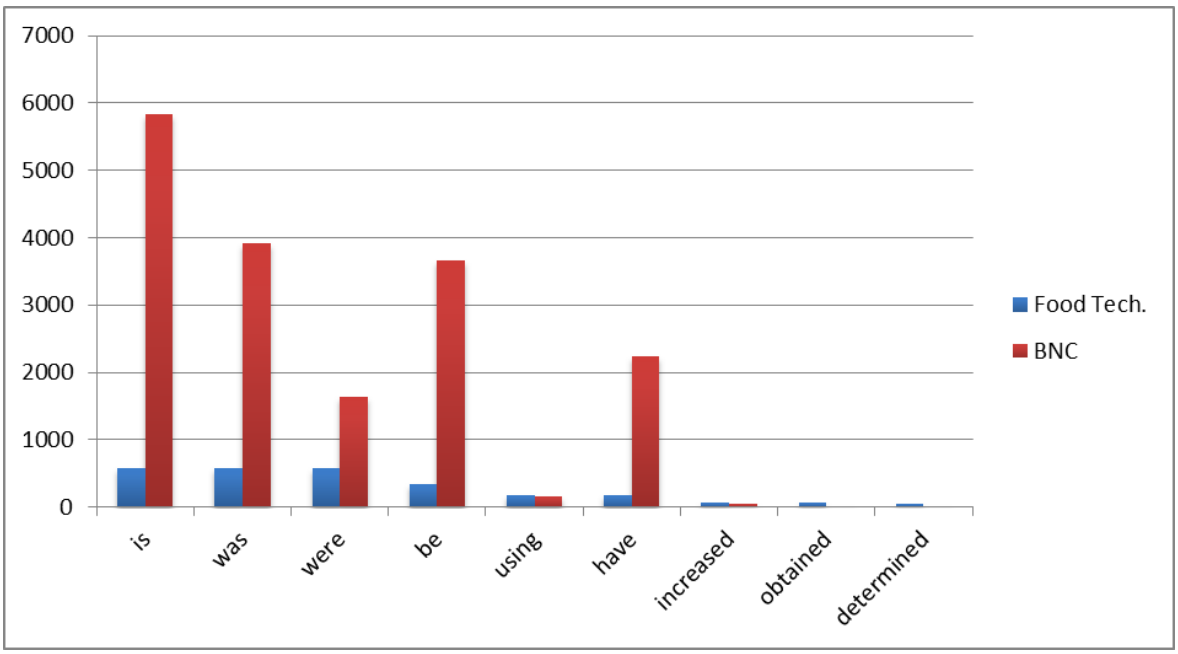

Figure 12 – Frequency of verbs in Food Technology and in BNC

The frequency of verbs is higher in the field of Polymers Technology than in Food Technology. Figure 13 indicates that the lowest frequency is in the year 1997. To compare the low frequency in the year 1997 with the frequency in Food Technology, it is evident that in this year the frequency of depict verbs is the lowest in both corpora. This might be caused by the small sample used for the analysis or by the authors. The verbs *increased* and *obtained* are also used quite often in the whole corpus of Polymers Technology. This might mean that both fields are proving their ideas through research. From the point of time the frequency of verbs differs quite conwsiderably but it depends on the usage of verbs by the authors and the topic on which they focus. There is no visible trend from 1996 to 2013.

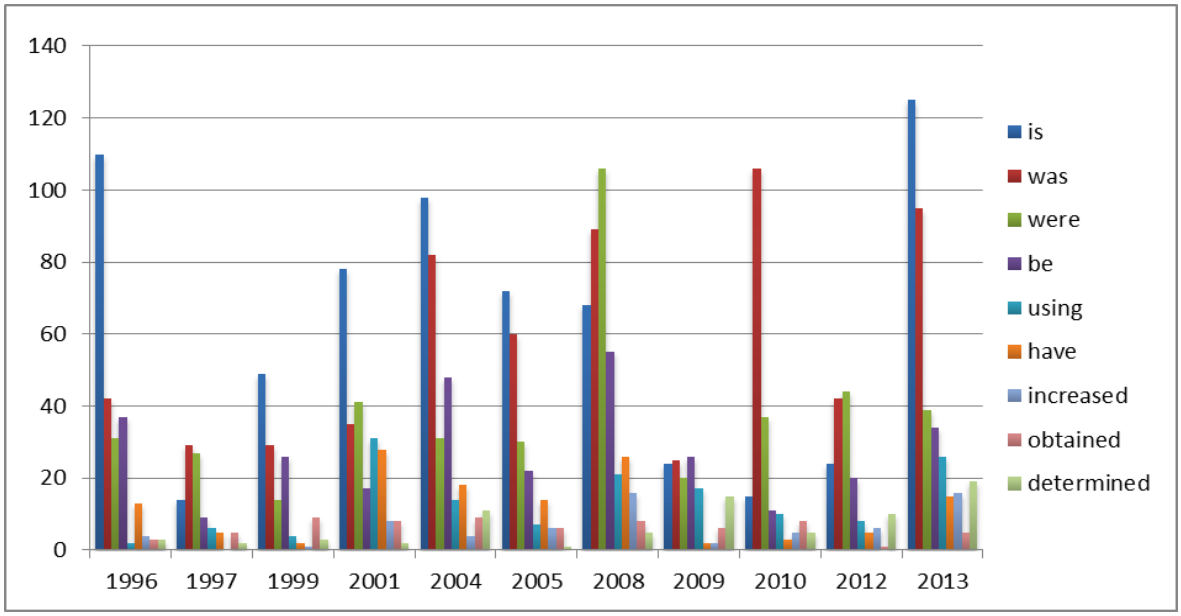

Figure 13 - Frequency of verbs in Polymers Technology

In Figure 14 the frequency of verbs in Polymers Technology and in BNC is compared. The verbs *obtained* and *determined* were not part of the BNC corpus and because of this they could not be part of the comparison. As it shows, the frequency is higher in the BNC corpus. It is important to mention that BNC uses more words for the corpus and this is why the results are so different. Nevertheless, it is apparent that the usage of these verbs is frequent both in technical writing and informative writing.

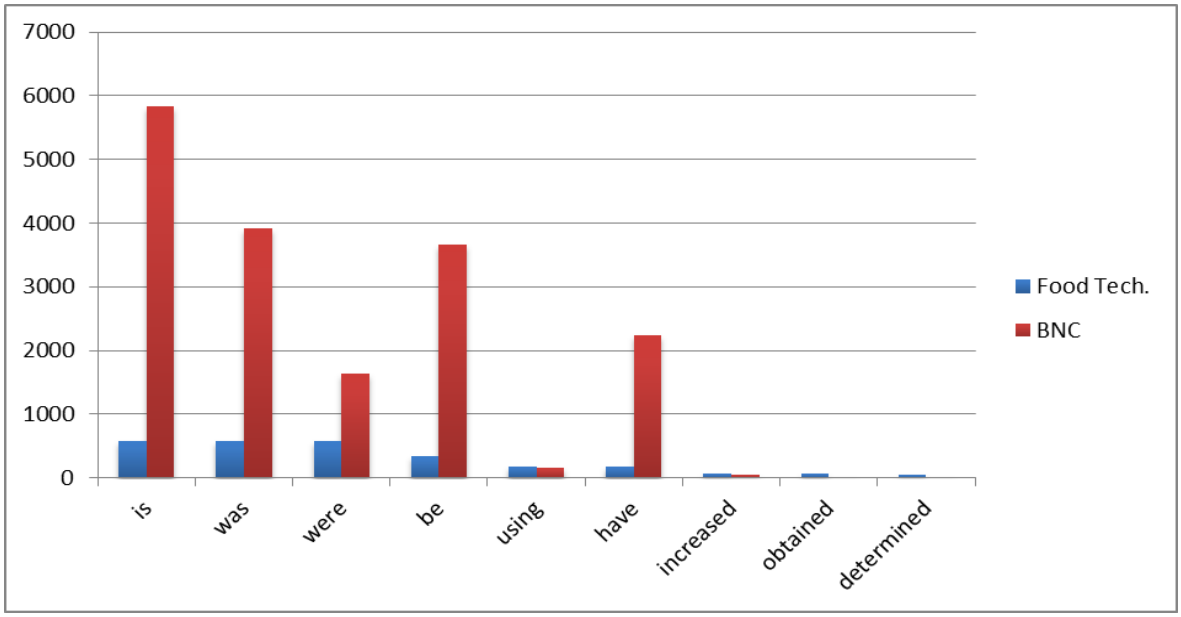

Figure 14 – Frequency of verbs in Polymers

3.2.6 Other parts of speech

Adjectives are used to describe nouns and to help express the writers' opinion or what he or she is trying to prove. The words *high* and *higher* are located in texts in each year but their frequency differs. On the other hand, the frequency of the words *low* and *lower* is almost identical if we compare the words in every year. The field of Polymers Technology uses more adjectives than the field of Food Technology. This is because Polymers Technology is a more closed field, whereas Food Technology is very open and can examine broader topics. The words *high, higher* and *low, lower* are in every year of publishing and are very frequent in the analysed corpus. This might be caused by the fact that these adjectives serve as modifiers of nouns which need this modification to prove ideas.

Pronouns are commonly used in informative writing, whereas in technical writing the usage is lower because of the formality of the style. The most frequent pronouns are *this, it* and *these*. They are used for the description of things that were mentioned in previous sentences. Because of this they are frequently used in these texts. The usage of personal pronouns in the Polymers Technology corpus and in the Food Technology corpus is very low. As Oshima and Hongue prove (Oshima and Hogue 1997), the usage of personal pronouns is low because the authors write in an academic style. Comparing the frequency in the Food Technology corpus and in the Polymers technology corpus, it is obvious that the frequency is higher in Food Technology. This might be caused by the repetition of words.

Adverbs are put in the sentences to modify and are not frequently used in Food Technology. In the year 1997, only few of them were used and then they started to be used often but not as often as in Polymers Technology. The most frequent word *only* is used in texts in every year and it is the most frequent adverb in the year 2004. This indicates that the author of the article wanted to describe his or her idea in more detail. From the point of time, the frequency of adverbs in the Food Technology corpus is increasing from 2001, but the usage is reduced in 2003. This might be caused with the small sample of texts. On the other hand, in the Polymers Technology corpus the frequency is very various. 2008 is the year with the highest frequency. The diversity between both corpora is significant.

When **prepositions** are used, they indicate some kind of relationship. The frequency differs in some years, but the difference is not very significant. Some prepositions are more frequent in Food Technology and some are more frequent in Polymers Technology. The usage of certain prepositions depends on the topic which is being examined. The analysis

proves that prepositions are used in technical fields quite often. It also shows that the preposition *of* is the most frequent one and it is part of every researched text. From the point of time, the frequency in Food Technology is increasing from 2000, but in 2005 decline is significant. However, in Polymers Technology there is no clear trend in the usage of prepositions.

Conjunctions are used here to connect sentences and build more complex ones. They are used in these fields because the authors need to write more complex sentences to prove their points. It is not possible to express an idea in this field by writing only short sentences. The results show that the frequency of the conjunction *and* is the second highest in the whole corpus. This conjunction is located in every text and is used very often since it connects two words or sentences together. Although other conjunctions are used, their frequency is not very high. Every conjunction listed in the analysis is used in the texts at least once. These conjunctions help to keep the text flowing and they show the relationship between two points. The usage of conjunctions is higher in the field of Food Technology than in the field of Polymers Technology. From to point of time, the frequency seems to be decreasing in the Food Technology corpus from 2004.

CONCLUSION

The aim of this bachelor thesis was to analyse the frequency of parts of speech in chosen technical research papers and it was divided into two parts: a theoretical part and a practical one.

The theoretical part aimed to clarify the parts of speech in general English and academic English, particularly nouns, adjectives, pronouns, verbs, determiners, adverbs, prepositions and conjunctions. Practical examples were incorporated to support the theory. The next part of the theory described the frequency of parts of speech in the British National Corpus because in the practical part a comparison was made with the analysed corpus.

The practical part dealt with the analysis of the corpus which was built from thirty technical research articles from the fields of Food and Polymers Technology. The program WordSmith Tools was used for the creation of the corpus. The frequency of parts of speech had to be counted manually, which was quite time-consuming. The analysed corpus was compared with the British National Corpus to show the diversity between the frequencies of parts of speech in technical writing and informative writing. Moreover, the corpus was divided into two parts to show the differences of frequency of parts of speech in Food and Polymers Technology articles. As the analysis shows, the frequency of nouns and verbs in the whole corpus is high. This is given by the usage of technical English and the use of passive voice. The comparison of the analysed results with the frequency in the British National Corpus differs quite lot because the frequency of BNC had to be reduced. The frequency was per million words and had to be lowered to 175 thousand words. It is important to stress that the results of comparison, as in the whole corpus or in the individual parts of speech comparison, have to be viewed in consideration of these limits. In conclusion, the figures show there are very frequent words which are used on daily basis even though this research has been done on specialised fields of technology. The analysis indicates that the style of technical articles is similar because of the frequency of parts of speech in Food and Polymers Technology.

There is a possibility to continue with this research based on building a larger corpus. This in turn would allow the possibility to compare the frequency with the British National Corpus without reducing the frequency. This might yield more relevant results.

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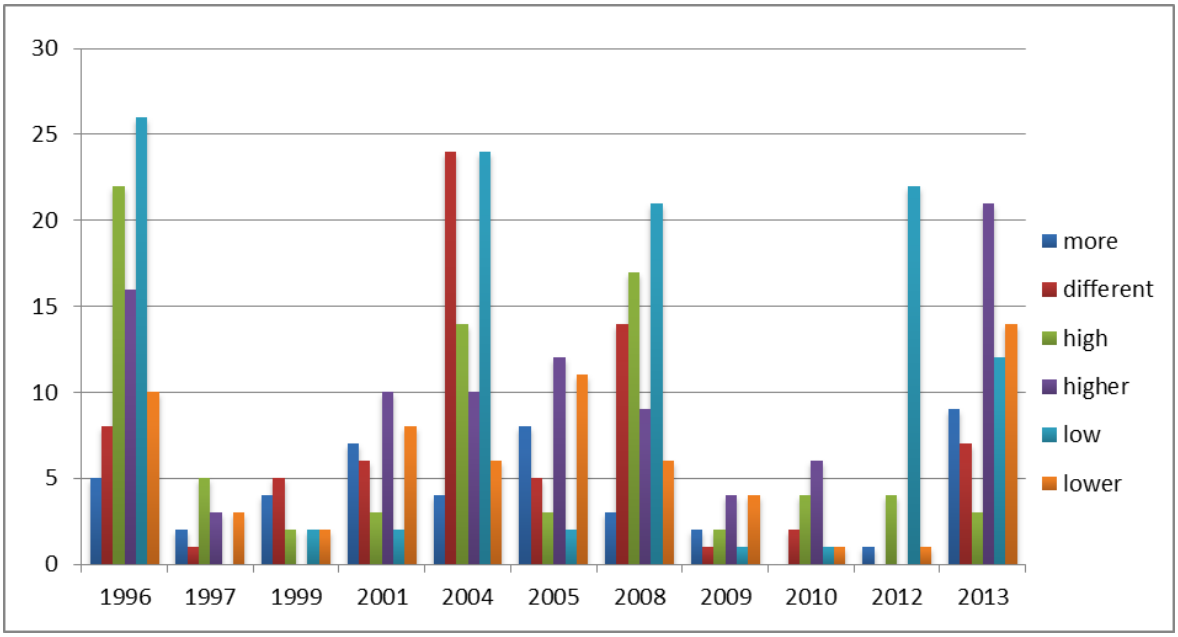
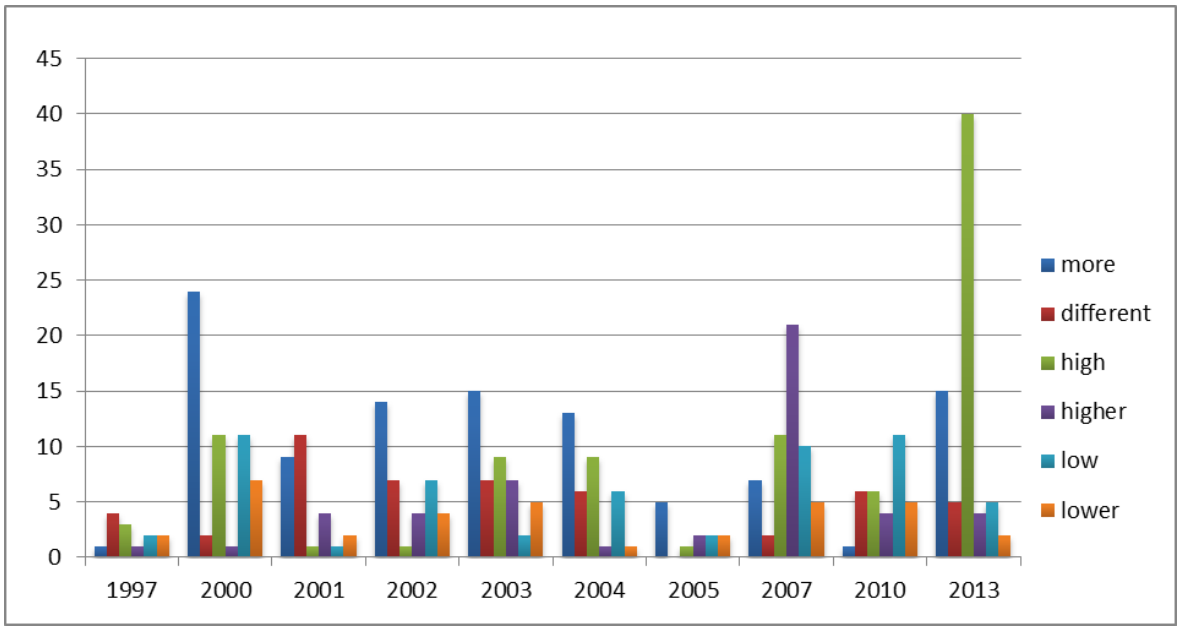


Figure 15 – Frequency of adjectives in Food Technology



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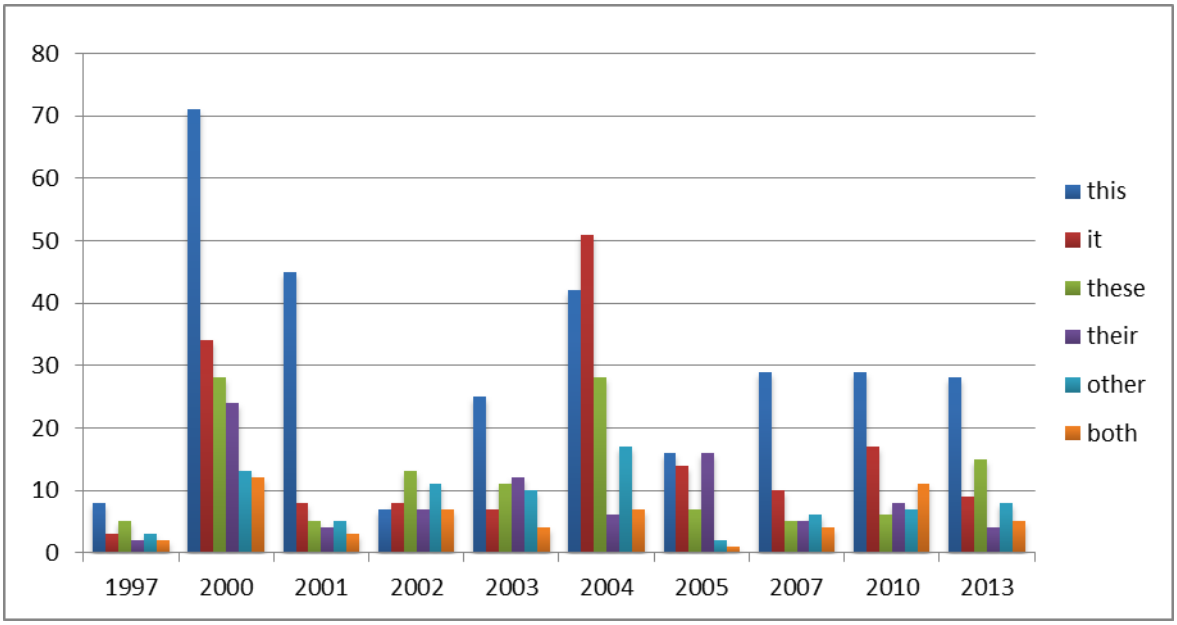

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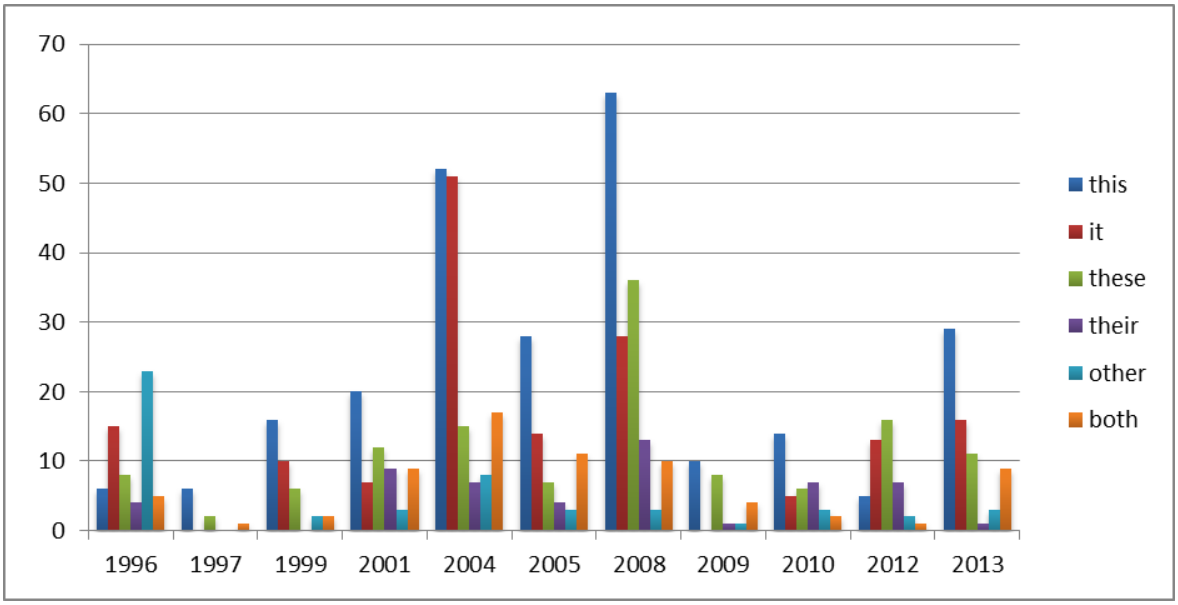

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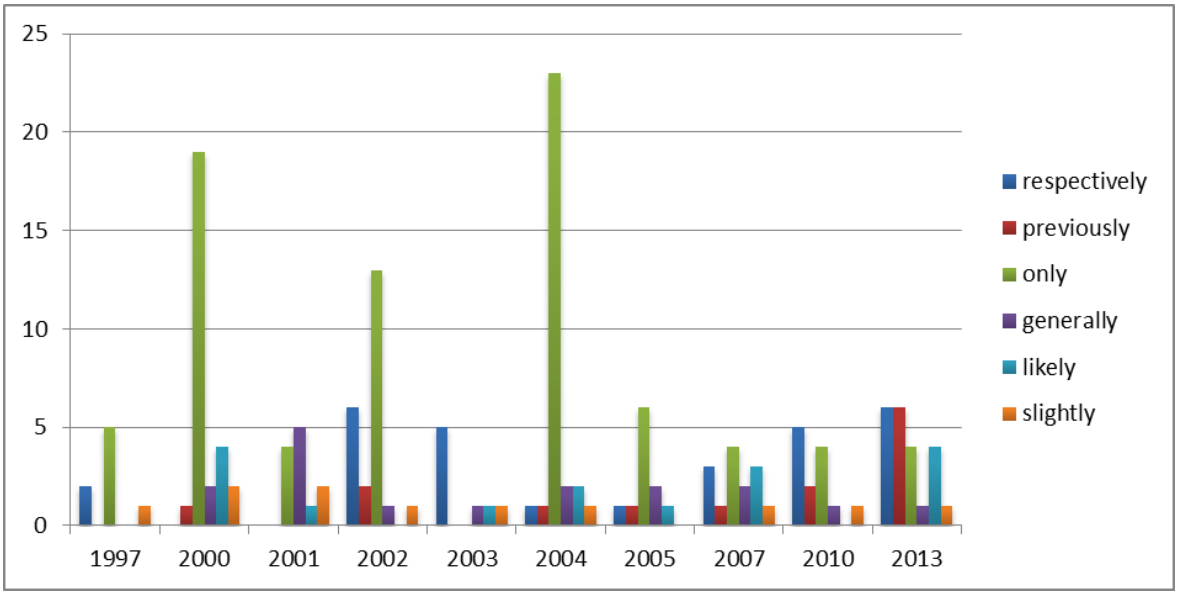

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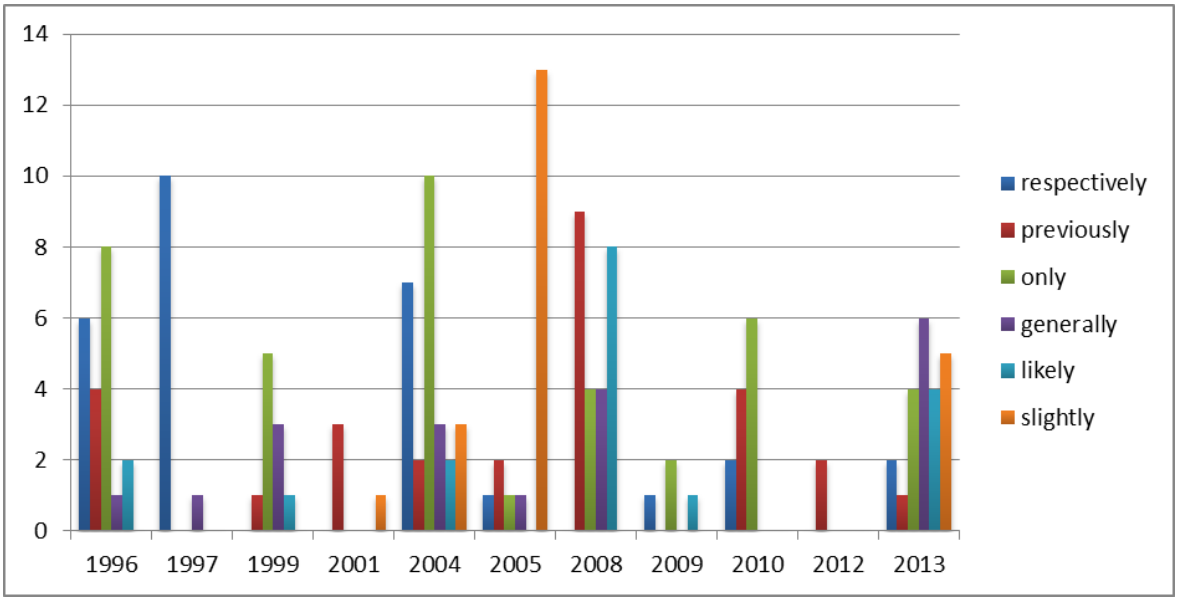

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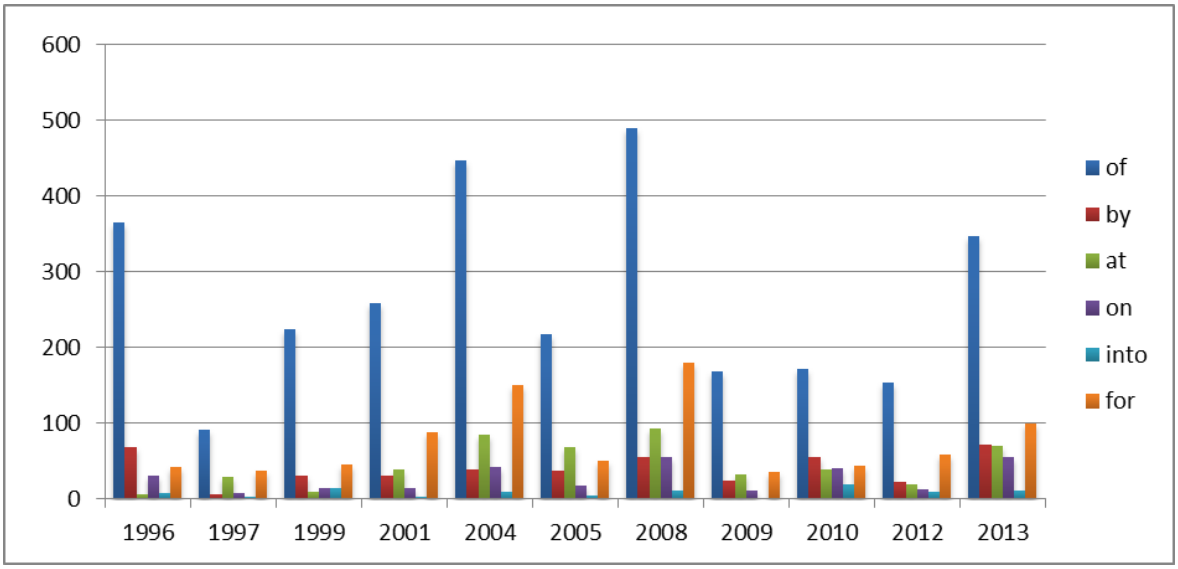

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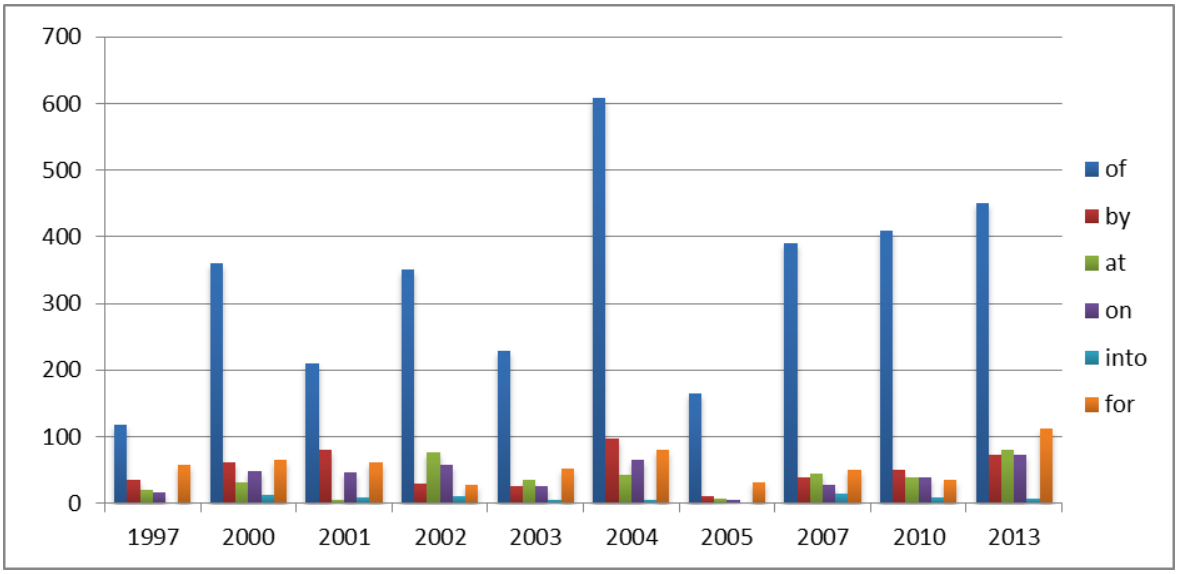

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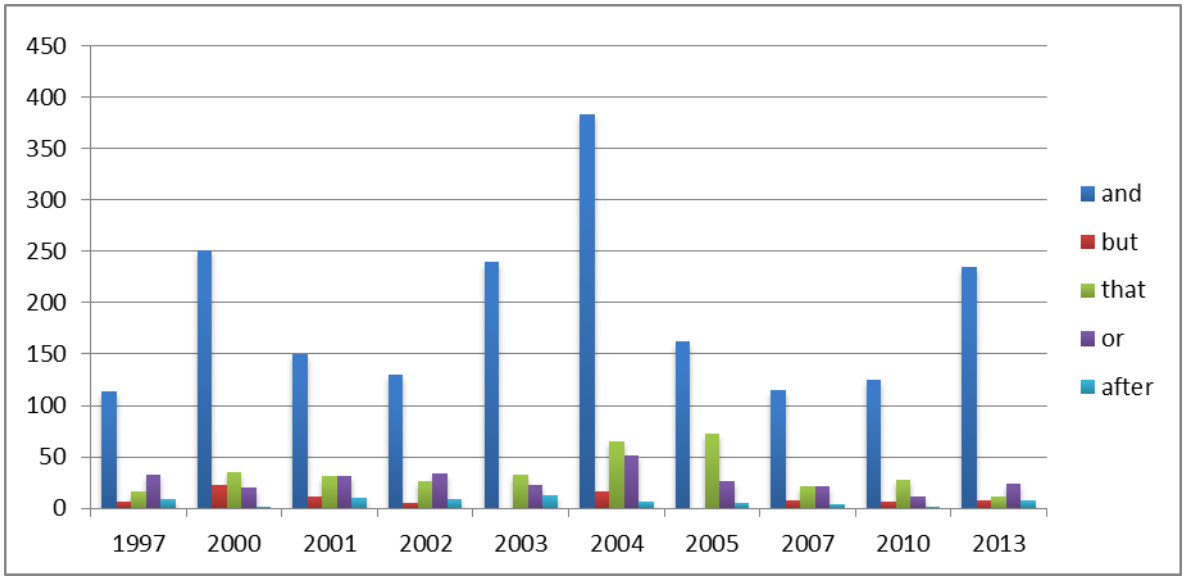

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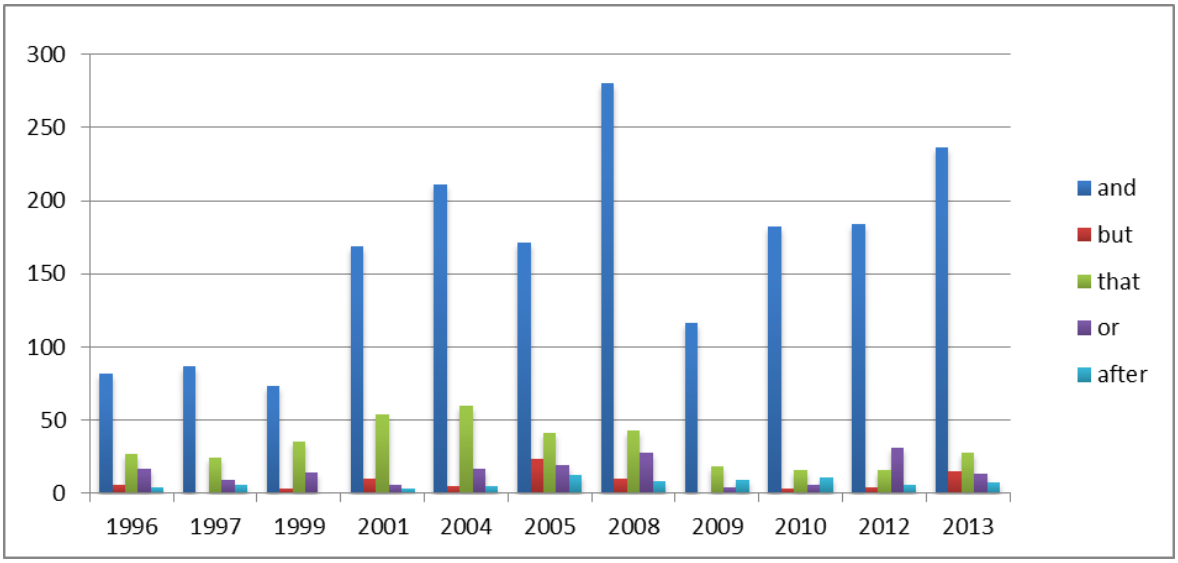

Figure 24 – Frequency of conjunctions in Polymers Technology