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# Analysis of Class XI High School Chemistry Textbooks on Hydrocarbon Compounds

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**Abstract**: **Analysis of Class XI High School Chemistry Textbooks on Hydrocarbon Compounds**. This study is to analyze the concept label and the suitability of teaching materials to the 2013 curriculum on hydrocarbon materials. The research method is descriptive qualitative. Data collection time starts from September 2021. The research instrument is a Concept Analysis Table which is adjusted to the KD in the K13 Syllabus. The data analysis technique used is by observing the textbooks that will be used in K13. There are two books that will be analyzed in this research. The results of this study indicate that among the 42 types of concept labels in the hydrocarbon material, there are 37 types of concept labels in book A, 31 types of concept labels in book B, 26 types of concept labels which are the same in books A and B, 11 types of concept labels that are only found in book A, as well as 5 types of concept labels that are only found in book B.

**Keywords**: Analysis, Hydrocarbons, Teaching Materials

***Abstrak**: **Analisisa Buku Ajar Kimia SMA Kelas XI Pada Materi Senyawa Hidrokarbon.** Penelitian ini untuk menganalisa label konsep dan kesesuaian materi ajar terhadap kurikulum 2013 pada materi hidrokarbon. Metode penelitian adalah kualitatif deskriptif. Waktu Pengumpulan data dimulai dari September 2021. Instrumen penelitian adalah Tabel Analisis Konsep yang disesuaikan dengan KD pada Silabus K13. Teknis analisis data yang dilakukan ialah dengan mengobservasi buku ajar yang akan digunakan pada K13. Terdapat dua buku yang akan dianalisis pada penelitian ini. Hasil penelitian ini menunjukkan diantara 42 jenis label konsep yang ada di pada materi hidrokarbon, terdapat 37 jenis label konsep yang ada di buku A, 31 jenis label konsep yang ada di buku B, 26 jenis label konsep yang sama dimiliki oleh buku A dan B, 11 jenis label konsep yang hanya ditemukan pada buku A, serta 5 jenis label konsep yang hanya terdapat di buku B.*

***Kata Kunci**: Analisis, Hidrokarbon, Materi Ajar*

## ▪ INTRODUCTION

Education is one of the main vehicles for intellectual and professional development as it plays an important role in supporting Indonesia's competitive global power (Sukasni, and Effendy. 2017:184). Education is interconnected with the curriculum. The Indonesian government is very centralized, giving the Ministry of Education and Culture full authority to design the structure and select all components to be included in the curriculum (Faisal and Martin, 2019:4). K-13 is applied in grades 1,2, 4 and 5 (for elementary school), grade 7, 8, (for junior high school) and grades 10 and 11 (for high school) (Nuraeni, et al. 2020:14). K-13 contains four elements of change. They are (1) graduate competency standards, (2) content standards, (3) learning process standards, and (4) assessment standards (Prihantoro, 2014:77). K-13 includes attitudes, cognitive and individual development of students in the fields of religion, art, creativity, values, communication, and various dimensions of intelligence that are in accordance with students and the needs of society, nation and mankind (Kemendikbud RI, 2014).

The curriculum is an important aspect in advancing the quality of education in Indonesia. In the world of Indonesian education, the applicable curriculum is the 2013 curriculum. 2013 curriculum learning is learning that uses authentic assessment to achieve attitude, knowledge and skill competencies (Inayah, 2014). In the 2013 curriculum, learning materials are focused on the formation of students' skills and character through scientific skills, this is intended so that students can understand the concepts learned in real terms. Scientific learning encourages students to be able to observe, ask questions, try, and communicate (Mulyasa, 2013).

Chemistry has a high level of difficulty so it is not easily understood by students, this is due to the lack of students' conceptual understanding of chemistry (Middlecamp and Kean, 1985). Chemistry contributes in helping people solve complex life problems. In fact, it was found that many students learn chemistry not because they are interested and then they do not have an understanding after studying chemistry (Alkan, 2016; Tarhan & Sesen, 2013; Scott, 2013). Chemical concept is the concept of multilevel, meaning that evolved from simple concepts to more complex concepts(Robby Zidny et al, 2013). Wang and Barrow (2011) revealed, to fully understand chemistry students must be able to understand chemical concepts at various levels of chemical representation and make connections between levels of representation. Thus, educators are required to present meaningful chemistry learning so that students are interested in learning it as a provision to face the global era of competition (Rusmansyah, et al. 2018:60).

The difficulty of students in understanding the concept of chemistry as a whole (can connect the three levels of chemical representation) is often not known by the teacher, because according to Treagust, et al (2003) teachers often assume that students are able to connect the three levels. representation itself. Students who have difficulty connecting the three levels of chemical representation will have an incomplete understanding. Incomplete understanding of students can cause students' mental models to be wrong. This wrong mental model will lead to alternative interpretations that are different from the scientific view or are called misconceptions (Tu¨may, 2014).

Hydrocarbons are one of the materials that have characteristics that are generally not liked and found difficult by students. Difficulties in studying hydrocarbon material include: (1) the facts of terms in hydrocarbon material are many and varied and must be memorized by students, (2) some terms in hydrocarbon material are generally compound names, which for most students are still very difficult to understand. . foreign because it is not seen in everyday life, (3) Hydrocarbon material is a broad material, so the process of delivering material in class takes a longer time.

From the results of research conducted by Qadriyah (2020) misconceptions occur in hydrocarbon materials by 29.8% (low category). Misconceptions were identified in 7 concepts of hydrocarbon materials, including: the concept of Hydrocarbon Compounds (22.1%), Specificity of Carbon Atoms (23.6%), Types of Carbon Atoms (22.9%), Structure and Nomenclature of Hydrocarbon Compounds (24, 8%), Physical and Chemical Properties of Hydrocarbon Compounds (38.7%), Isomers (45.1%), and Reactions of Hydrocarbon Compounds (31.4%).

Based on the results of interviews with chemistry teachers conducted at SMA Negeri 8 Medan, it was stated that in 2020 11 out of 36 students had difficulty understanding concepts on hydrocarbon material, meaning that 30% of students had misconceptions on hydrocarbon material. The most common misunderstandings occur in the IUPAC sub-material and the nomenclature of Trivial compounds, as well as the determination of isomerism in hydrocarbon compounds. This is evidenced by the student's test scores, which on average only get 60 points. The cause of the misconception is that the teaching materials used do not meet the demands of the 2013 curriculum.

Based on the data obtained, appropriate teaching materials are needed that can guide students' thinking so that they can be directed according to the applicable curriculum. Therefore, it is necessary to review what material is presented in the book and how its contents are in accordance with the goals or achievements set by the 2013 curriculum. The analysis of this textbook is expected to be able to provide input and considerations so that the book can be standardized and avoid errors. . concepts (misconceptions) in chemistry learning.

Based on the background that has been described, the formulation of the problem in this research is as follows: (1) How is the suitability of the concepts in class XI hydrocarbon chemistry teaching materials with the 2013 curriculum. (2) What is the proportion that causes misconceptions in hydrocarbon materials.

## ▪ METHOD

The method used in this research is descriptive qualitative research method. The descriptions carried out are the results of the analysis of concept labels and the suitability of teaching materials to the 2013 curriculum on hydrocarbon materials. Data collection time starts from September 2021. The instrument used to obtain data is a Concept Analysis Table which is adapted to the KD in the 2013 curriculum syllabus. The technical analysis of the data carried out is by observing the textbooks that will be used in K13. There are two books that will be analyzed in this research. chemistry book by A.Haris Watoni, dkk. (2016) and Unggul Sudarmo (2017)

## ▪ RESULTS AND DISCUSSION

This study will explain the relationship between the suitability of the hydrocarbon concept/topic label in chemistry teaching materials for class XI IPA SMA/MA to the 2013 curriculum. Comparison of concepts contained in books A and B are as follows:

**Table 1.** Concept Analysis Table

| No. | Concept/Topic Labels | Book A | Page | Book B | Page |
|---|---|---|---|---|---|
| 1 | Organic Compound | √ | 3 | √ | 5 |
| 2 | Carbon Identification | √ | 4 | √ | 7 |
| 3 | Source of Carbon Compound | - | - | √ | 8 |
| 4 | Properties of the Carbon Atom | √ | 5 | √ | 8 |
| 5 | Hydrocarbons | √ | 6 | √ | 10 |
| 6 | Trivial Naming | √ | 8 | - | - |
| 7 | IUPAC/Systematic Naming | √ | 9 | - | - |
| 8 | Primary C atom | √ | 12 | √ | 10 |
| 9 | Secondary C Atom | √ | 12 | √ | 10 |
| 10 | Tertiary C Atom | √ | 12 | √ | 10 |
| 11 | Quaternary C Atom | √ | 12 | √ | 10 |
| 12 | Chain Isomers | √ | 20 | √ | 23 |
| 13 | Functional Isomers | √ | 20 | - | - |
| 14 | Position Isomers | √ | 20 | √ | 23 |
| 15 | Chirality | √ | 22 | - | - |
| 16 | Optical Isomers | √ | 22 | - | - |
| 17 | Geometric Isomers | √ | 24 | √ | 24 |
| 18 | Alkanes | √ | 10 | √ | 11 |
| 19 | Alkane Homologous Series | √ | 11 | √ | 12 |
| 20 | Alkane Nomenclature | √ | 14 | √ | 13 |
| 21 | Physical Properties of Alkanes | √ | 26 | √ | 18 |
| 22 | Alkene | - | - | √ | 19 |

| No. | Concept/Topic Labels | Book A | Page | Book B | Page |
|---|---|---|---|---|---|
| 23 | Alkene Nomenclature | √ | 18 | √ | 21 |
| 24 | Physical Properties of Alkenes | √ | 27 | √ | 25 |
| 25 | Alkyne | - | - | √ | 27 |
| 26 | Alkyne Nomenclature | √ | 18 | √ | 28 |
| 27 | Physical Properties of Alkynes | √ | 29 | √ | 29 |
| 28 | Source of Alkanes | √ | 30 | - | - |
| 29 | Uses of Alkanes | √ | 30 | √ | 31 |
| 30 | Alkene Source | √ | 30 | - | - |
| 31 | Uses of Alkenes | √ | 30 | √ | 31 |
| 32 | Alkyne Source | √ | 31 | - | - |
| 33 | Uses of Alkynes | √ | 32 | √ | 31 |
| 34 | Alkane Combustion Reaction | √ | 33 | √ | 19 |
| 35 | Cracking Alkanes | √ | 34 | - | - |
| 36 | Alkane Halogenation | √ | 34 | √ | 19 |
| 37 | Alkene Hydrogenation | √ | 35 | √ | 25 |
| 38 | Alkene Halogenation | √ | 35 | √ | 25 |
| 39 | Alkene Hydrohalogenation | √ | 36 | - | - |
| 40 | Alkene Hydration | √ | 36 | - | - |
| 41 | Alkene Homologous Series | - | - | √ | 21 |
| 42 | Alkyne Homologous Series | - | - | √ | 27 |

Information :

: Concept labels found in textbooks A and B

: Concept labels only found in textbook A

: Concept Labels only found in textbook B

The concept labels between books A and B in Table 1 have been identified, adjusted based on basic competencies (KD) in the 2013 curriculum with the following results:

**Table 2.** Conformity of Concept/Topic Labels Between Books A and B on KD and Material

| Basic Competence (KD) | Material | Concept Label | Compliance with Syllabus | | | |
|---|---|---|---|---|---|---|
| | | | KD | | Material | |
| | | | Book A | Book B | Book A | Book B |
| 3.1 Analyzing the structure and properties of hydrocarbon compounds based on the peculiarities of the carbon atom and the group of compounds<br><br>4.1 Create visual models of various molecular structures of hydrocarbons that have the | a. Introduction to carbon compounds<br>b. identification of carbon compounds<br><br>c. the peculiarity of the carbon atom<br><br>d. hydrocarbon classification<br><br>e. Alkanes<br><br>f. Alkene<br><br>g. Alkyne | Organic Compound | 3.1 | 3.1 | a | a |
| | | Carbon Identification | 3.1 | 3.1 | b | b |
| | | Properties of the Carbon Atom | 3.1 | 3.1 | c | c |
| | | Hydrocarbons | 3.1 | 3.1 | d | d |
| | | Primary C atom | 3.1 | 3.1 | c | c |
| | | Secondary C Atom | 3.1 | 3.1 | c | c |
| | | Tertiary C Atom | 3.1 | 3.1 | c | c |
| | | Quaternary C Atom | 3.1 | 3.1 | c | c |
| | | Chain Isomers | 4.1 | 4.1 | i | i |
| | | Position Isomers | 4.1 | 4.1 | i | i |
| | | Geometric Isomers | 4.1 | 4.1 | i | i |
| | | Alkanes | 3.1 | 3.1 | e | e |
| | | Alkane Homologous Series | 3.1 | 3.1 | e | e |
| | | Alkane Nomenclature | 3.1 | 3.1 | e | e |
| | | Physical Properties of Alkanes | 3.1 | 3.1 | e | e |

| Basic Competence (KD) | Material | Concept Label | Compliance with Syllabus | | | |
|---|---|---|---|---|---|---|
| | | | KD | | Material | |
| | | | Book A | Book B | Book A | Book B |
| same molecular formula | h. Reactions in hydrocarbons<br>i. Hydrocarbon Isomers | Alkene Nomenclature | 3.1 | 3.1 | f | f |
| | | Physical Properties of Alkenes | 3.1 | 3.1 | f | f |
| | | Alkyne Nomenclature | 3.1 | 3.1 | g | g |
| | | Physical Properties of Alkynes | 3.1 | 3.1 | g | g |
| | | Uses of Alkanes | 3.1 | 3.1 | e | e |
| | | Uses of Alkenes | 3.1 | 3.1 | f | f |
| | | Uses of Alkynes | 3.1 | 3.1 | g | g |
| | | Alkane Combustion Reaction | 3.1 | 3.1 | h | h |
| | | Alkane Halogenation | 3.1 | 3.1 | h | h |
| | | Alkene Hydrogenation | 3.1 | 3.1 | h | h |
| | | Alkene Halogenation | 3.1 | 3.1 | h | h |
| | | Trivial Naming | 3.1 | - | d | - |
| | | IUPAC/Systematic Naming | 3.1 | - | d | - |
| | | Functional Isomers | 4.1 | - | i | - |
| | | Chirality | 4.1 | - | i | - |

| Basic Competence (KD) | Material | Concept Label | Compliance with Syllabus | | | |
|---|---|---|---|---|---|---|
| | | | KD | | Material | |
| | | | Book A | Book B | Book A | Book B |
| | | Optical Isomers | 4.1 | - | i | - |
| | | Source of Alkanes | 3.1 | - | e | - |
| | | Alkene Source | 3.1 | - | f | - |
| | | Alkyne Source | 3.1 | - | g | - |
| | | Cracking Alkanes | 3.1 | - | h | - |
| | | Alkene Hydrohalogenation | 3.1 | - | h | - |
| | | Alkene Hydration | 3.1 | - | h | - |
| | | Source of Carbon Compound | - | 3.1 | - | a |
| | | Alkene | - | 3.1 | - | f |
| | | Alkyne | - | 3.1 | - | g |
| | | Alkene Homologous Series | - | 3.1 | - | f |
| | | Alkyne Homologous Series | - | 3.1 | - | g |

Description - : No concept label

: Equation of concept labels in books A and B

: Concept labels only found in textbook A

: Concept Labels only found in textbook B

## ▪ CONCLUSION

Based on the results of the analysis carried out by the two textbooks, it can be concluded that among the 42 types of concept labels in the hydrocarbon material, there are 37 types of concept labels in book A, 31 types of concept labels in book B, 26 types Books A and B have the same concept labels, 11 types of concept labels that are only found in book A, and 5 types of concept labels that are only found in book B. The proportion that can cause misconceptions in books A and B is in the trivial planting sub-material. , IUPAC/Systematic naming, functional isomers, Chirality, optical isomers,

alkane sources, alkene sources, alkyne sources, alkane cracking, alkene hydrohalogenation, alkene hydration, carbon compound sources, alkenes, alkynes, alkene homologous series, and alkyne homologous series. Thus, book B has more potential to cause misconceptions, due to the lack of basic concepts that should be described in textbooks. The use of book B should be accompanied by the addition of other books so that concepts that are not explained in book B can be fulfilled from other books.

This research is expected to assist teachers in selecting students' needs based on the basic competencies required by the curriculum. As well as being a grip on what concepts should be in student textbooks, so that teachers can easily make their own teaching materials.

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