The Development of Refreence Book Based on the Research about the Amylolytic Bacteria in Sago Waste Product at Halmahera Island for the Student

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Abstract: The reference book is a learning media that need by student in the learning process, the material used as the substance in the reference book making is the better from the research result based on the locally resources. The sago waste product is found at the sago processing place and cause environs mental pollution. In sago waste product were found some amylolytic bacteria species that could degrade amylum to be simple compound. This research used methods is descriptive, this research is done to make a reference book based on the research result. The research result proved that there are three amylolytic bacteria species *Bacillus alvei*, *B. amyloliquefaciens*, and *Pseudomonas putida*. From three bacteria species, *Bacillus alvei* have the highest amylase enzyme activity, to this bacteria is very potential for food industry, especially in amylum hydrolysis process. The need analysis results showed that 100% respondent need reference book about the amylolytic bacteria from the sago waste product. The result is the substance used for the reference book making consist of: the amylolytic bacteria species and the amylase activity of each bacteria species.

Keywords : amylolytic bacteria, sago waste product, amylase activity, reference book.

Book as a source of information that originated from observations, researches, and literature studies will contain important information needed by students. Books compiled should be based on local resources thus they will add new knowledge for students. According to Inotji (2000), reference materials in form of books contain information that generally compile in systematic way and to be given to readers who need supplement or additional information when they read their literature sources.

College students (hereinafter, students), in North Moluccas has known and familiarized with the existence of sago (*Metroxylon sago*), which is the daily diet that is equal to other staple foods such as rice. The existence of traditional processing is beneficial for the surrounding societies who processed sago as the livelihood. However, the residual of the production process gives impact to the environment. Unused sago waste is discarded to soil and water causing environmental pollution. The discarded sago waste, according to Naiola (2012), generally, still contains amylum 15-30%, amylose 70-85% and amylopectin 5%. The content of amylum gives opportunity for amylolytic bacteria to grow using the nutrient in sago waste. The existence of local resources is very important to be raised and packaged in form of reference books needed by students in their learning process and by general researchers. In addition, the compiled reference books will add knowledge to students on the existence of bacteria in sago waste that traditionally processed by societies in North Moluccas, especially in Halmahera Island.

The management of natural resources and environment refers to UU RI No. 23, 1997 on the management of environment. It is stated in article 1 paragraph 2 that the management of environment is an integrated effort to conserve the function of environment consisting of policy on the regulation, utilization, development, maintenance, restoration, supervision and control

of environment. One of ways in developing local resources in this research is by developing local resources-based reference books for students in Ternate colleges. According to Sulistyo (1993), the characteristics of reference books are: they are not lent in the library and the information is compiled to facilitate quick and thorough research since it is arranged according to title, subject, and chronology along with an index for retrieval. The compiled books stated the existence of amylolytic microbe, especially for microbiology course. In microbiology course there is a subject on hydrolyzing bacteria from amylum, protein, fat and others. Therefore, sub-material presented in the reference books will give more new information to add reference in writing and to help students' learning process.

It is expected that the development of reference books has the following advantages: interesting material packaging accompanied by documentations of sampling, identification method and result of conducted researches, and information on relevance literatures. Reference book is chosen as development tool since it is flexible and does not refer to the existing curriculum.

Research Purpose

The purpose of the research is to produce reference book consisting of material and sub subject that discuss on amylolytic bacteria from sago waste in Halmahera Island as a learning base by utilizing local resources of Halmahera Island.

METHOD

Research Model and Development

The research used observation technique for the need of students' study material; whereas, the development of reference book was based on Borg and Gall with limitation only for four steps: (1) research and data collection, (2) planning, (3) drafting of reference book of microbiology, (4) expert validity test, (5) product revision, (6) small group test, and (7) final product revision.

DISCUSSION

The Development of Reference Book of Microbiology

The research was the development of reference book of microbiology. It referred to Borg and Gall (2003) since it is more systematic. It was also hoped that the development model could help researchers in developing current reference source gained from pure research results. Reference book of microbiology consists of 10 chapters by presenting on the book issue as a whole. The chapters in the book begin with introduction, scope of study or material, and references with glossaries as a closing.

Topic on amylolytic microbe was chosen and developed based on the result of researches on indigenous amylolytic bacteria in waste of sago production that processed traditionally in Halmahera Island. A substance of discussion in every chapter will consist of introduction, method, result and discussion along with conclusion and reference. It is in line with requirements of scientific paper writing i.e. formulation of problem, support of data or up-to-date, detail and clear theory, and conclusion as well as reference.

Reference book of microbiology is aimed to biology students, especially for students who registered for microbiology course. It is, however, likely to be used by general researchers based

on their research needs in their field. The results of the observation sheet aims to get an overview of the importance of microbiological material needs by students, especially that amylolytic bacteria indigent on sago waste in the developed of reference book.

Material of microbiology in the reference books could add insight on indigenous amylolytic microbe in sago processed waste. Description on sampling and macroscopic and microscopic discussion could add students' knowledge on microbiology.

Material in the reference book of microbiology is presented narratively and no feedback mechanism. The reference book is compiled and wrote based on the writing rules of reference book set by Center for Curriculum and Book (2013), which are, it is not the fundamental guide for student and teacher and teacher in a learning activity, not accompanied by evaluation instruments and, not presented based on class/semester.

The product of the development is in form of reference book that has the following superiorities: (1) the book is compiled based on rules set by Directorate General of Higher Education (DIKTI) and not only aimed as reading material for students in academic environment, but it also can be used as one of alternatives source of reading for the societies; and (2) the book on microbiology is equipped with pictures gained from researches result conducted by researchers and literature study; therefore, students are able to study it.

Important Reference Books for Students

The development reference book of Microbiology is very useful because 1) it enables to find easily an item the material of bacteria amylolitic from sago waste and reader can consulted previously 2) it allows to pass on to a friend or colleague details of an item that to consulted, secure in the knowledge about the material that they will be able to trace it easily 3) it helps the reader understand how to have reached their conclusions.

The written reference book is a reference book of microbiology for colleges in Ternate that in line with the area of expertise or field of science of the authors, which is microbiology. The book also has specification and excellences that distinguish it from previous books. The composition of each chapter and sub-chapter is proportional and is using standard Indonesian Language (except of technical or scientific terms of the field of study). The font used in the reference book is Times New Roman based on the writing ethics. It is free from plagiarism and it never been published before or in the process of publishing (proven by a statement).

Borg and Gall (2003) used research and development steps (the R&D cycle) for education purpose. Those steps consist of the following: (1) research and information (research and information collection), measurement of needs, small scale research literatures study and consideration in term of values, (2) planning, the preparation of research plan will consist of abilities needed in the implementation of the research, formulation of problems, and purpose to be achieved in the research, design or research steps, and the possibility of test within the scope, (3) preliminary developing of material book was learning process and evaluation instruments, (4) ppreliminary form of product (preliminary product test) Field test. During the field test, observation, interview and questionnaire distribution are conducted, (5) main product revision to revise and finalize the result, (6) main field testing conduct a trial for more than 100 people of trial subjects, (7) operational product revision finalizing the product of field test result, (8) operational field testing. It is conducted by 10-30 schools and involving 40-200 subjects. The test is conducted through questionnaire, interview, observation and result analysis, (9) final product revision the finalization of the product is based on input from field implementation test, (10) Dissemination and implementation, utilization and distribution. The result was reporting of experiment in the professional meeting in journal and to have cooperation with publisher to

publish it. The following picture illustrates the chart of Development Procedure of Development Model.

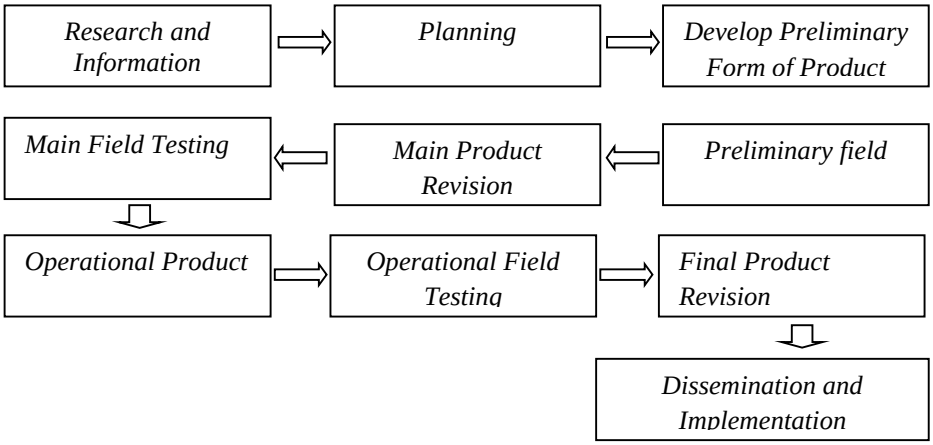

Figure 1. Chart of Development Procedure of Development Model of Research and Development (R&D) (adapted from Borg and Gall, 2003)

Following is the development of material to be discussed in reference book of microbiology for students and other researchers. Material raised are result of researches that adjusted to the need of microbiology course but it packaged based on local resources in Halmahera Island, which is waste sago production process that traditionally processed by the society.

Table 1. Systematic of Material Content in Reference Book of Microbiology

Item	Discussed Material
Title	Indigenous Amylolytic Bacteria from Waste of Sago Production Process in Amylum Hydrolysis: Its Character and Potential in Halmahera Island
CHAPTER I	Getting to Know the Production Process of Sago by Societies in Halmahera Island
CHAPTER II	Environmental pollution problems caused by sago waste
CHAPTER III	Indigenous bacteria in sago processed waste
CHAPTER IV	Activities of Amylolytic Bacteria
CHAPTER V	Prospect in the Use of Amylolytic bacteria in hydrolysis process of amylum in sago processed waste
CHAPTER VI	Isolation method of amylase enzyme produced by amylolytic bacteria
CHAPTER VII	Characteristics of amylase enzyme by amylolytic bacteria
CHAPTER VIII	Measurement techniques of activities of amylase enzyme from indigenous amylolytic bacteria
CHAPTER IX	Testing method of protein of amylase enzyme

CONCLUSION

The developed reference book consists of nine main chapters consisting of Getting to Know the Production Process of Sago by Societies in Halmahera Island; Environmental pollution problems caused by sago waste; Indigenous bacteria in sago processed waste; Activities of Amylolytic Bacteria; Prospect in the Use of Amylolytic bacteria in hydrolysis process of amylum in sago processed waste; Sample of researches that use indigenous

amylolytic bacteria in amylum hydrolysis; Isolation method of amylase enzyme produced by amylolytic bacteria; Characteristics of amylase enzyme by amylolytic bacteria; Measurement techniques of activities of amylase enzyme from indigenous amylolytic bacteria; and Testing method of protein of amylase enzyme.

Suggestion

The research is not perfect yet. Therefore, further researches are needed to complete it. Suggestion for future research is that exploration is needed on the potential of amylolytic bacteria from sago waste and a booklet should be produced for local society. The booklet is aimed for society to have more understanding on the meaning of ecosystem sustainability in the forest, especially for indigenous bacteria in sago waste.

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