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Просочування деревини водорозчинниими барвниками

Проведено дослідження з визначення оптимальних концентрацій водорозчинних барвників для забезпечення заданого кольору під час просочування деревини із застосуванням вакууму.

Ключові слова: деревина, барвник, просочування, вакуум.

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THE STUDY OF MODIFIERS IMPACT ON THE PROCESS OF PELLETIZING HARDWOOD WASTE

A process for pelletizing hardwood wherein the particulated wood is treated with a starch, wax emulsion and lignosulfonate prior to pelleting is disclosed.

Keywords: pelleting press, hardwood pellet, hardwood particulate materials.

With the increase in cost of energy, greater efforts are presently being made to utilize hardwood waste for heating. Generally the hardwood waste which is not in particulate form is reduced to particulate form and pelleted to obtain the waste in a uniform particle size which can be conveniently handled. In pelleting the hardwood, pellet mill with stationary die and rotating rollers is used wherein the particulated wood is compressed and forced through orifices in the die. These types of mills have high capacity for pelleting the large quantity of hardwood waste [1, 2]. It is, therefore, an object of this investigation to provide an improved process for pelleting of hardwood.

A further objective is to provide a process characterized by the production of hardwood pellets of improved durability. A still further objective is to provide a process wherein an increase in production rates may be obtained with a decrease in power costs.

The above and other objectives are attained by this research which comprises drying the particulate wood to a moisture content less than about 16 % and treating the particulate wood prior to pelleting with starch, an aqueous wax emulsion and lignosulfonate [3].

The particulate wood is treated with the starch, wax emulsion and lignosulfonate in an amount about 0.25 to about 2.5 weight percent of the wood, that permitted by EU standards. The amount of the starch, wax emulsion and lignosulfonate used in treating the wood and the ratio of wax to lignosulfonate solids used may be varied depending upon the species of wood being pelleted to obtain optimum results.

With some of the woods, the durability of the pellets may be one of the main concerns while with others, such as oak, the pellets obtained without the additive may be acceptable but the power requirements for the pelleting operation are excessive and the life of the die is relatively limited. Thus, for the latter higher wax content is desirable while for the former, such as beech, lower wax content may be used.

The extent of enhancement obtained by use of the additive will also vary with the species used, with some improvement being generally obtained for most soft and hardwoods and mixtures of waste woods which may contain many different species, bark and other lignocellulosic constituents.

The starch, mixture or emulsion of wax and lignosulfonate is usually applied to the particulate wood after it has been dried to a moisture content of less than about 16

%, preferably dried to a moisture content ranging of from about 12 to about 14 % or less. Usually the mixture of the wax and lignosulfonate is sprayed upon the dried products at the conditioning chamber prior to being fed into the pelleting machine.

The pelleting mills often use paddle conveyors or other means to feed the particulate wood into the pelleting die so that the treated wood particles are mixed prior to pelleting to obtain a sufficiently uniform mixture. The wax and lignosulfonate mixture or emlusion may also be applied to the wood particles prior to drying.

However, when this procedure is used the conditions and methods used in the drying operation are limited. Thus, it is generally preferred to dry the particles prior to the application of the starch, mixture of wax and lignosulfonate taking into account during the drying operation of the additions of water which will be made by the treatment of the particles with the mixture. In addition to for the treating step discussed above, other procedures normally used in pelleting of wood may be followed.

A production scale test was made using a production pellet mill which was driven by a 125 kWt motor. A die contained orifices of 8mm in diameter and had a thickness of 35mm through which the hardwood was forced. The pellet mill had a conditioning chamber. The starch was fed by conveyor, wax-lignosulfonate emulsion was sprayed on the wood particles in the conditioning chamber. The moisture content of the ground hardwood and product pellets was measured by a bench type moisture meter.

In making the test runs, the operator set the pellet machine at a maximum power load of 200 amperes. The machine was operated using beech particulated wood without any additive at this setting and the durability and rate of production determined. After this determination was made, the particulated wood was treated with a starch, wax-lignosulfonate emulsion in an amount of 1-3 weight percent of the particulated wood.

The wax-lignosulfonate emulsion was prepared by mixing the wax emulsion in an amount of 20 weight percent with 80 % of the 50 % lignosulfonate solution. Upon treatment of the particulated wood with the starch or wax-lignosulfonate emulsion, the power demand dropped and the operator increased the feed to the mill until a power demand of 200 amperes was being used by the machine.

The production rate on particulated wood without the additive was 600 kg per hour utilizing a power demand of 200 amperes. Upon addition of the additive, the production rate increased to 800 kg per hour and the power demand was 200 amperes.

The durability of the pellets without the additive was 94.5 % while that with the additive was 96.8 %. The moisture content for the wood during the first test run and with starch treated was 9 weight percent and at the time the pellets were treated with the wax-lignosulfonate emulsion the moisture content was 8 %. In pelleting oak, without the additive the production rate was 800 kg per hour at power demand of 200 amperes.

With additive added in an amount of 1 weight percent of the wood, the production rate increased to 880 kg per hour on a power demand of 150 amperes. The durability of the pellets without the additive was 92 % and 92.6 % with the additive.

After the treatment of the particulate wood with the wax-lignosulfonate mixture or emulsion was discontinued, the amperage on the pelleting mill after about 5 minutes began to increase and was up to 200 amperes about 6 minutes later.

The durability of the pellets was tested by screening the pellets on a 5 mesh screen and then taking a 100 gram sample of pellets remaining on the screen and shaking the sample in a can on a paint mixer for 4 minutes. After shaking, the sample was again screened on a 5 mesh screen and the percentage of the sample retained on the screen was reported as the durability of the sample. The material which passed through the screen on the first screening was weighed and the amount of fines thus obtained was expressed in grams of fines obtained per 100 grams of pellets.

In the tests made on the pellet mill, the beech wood was pelleted without any additive and also where the particulated wood was treated with a wax emulsion alone and also with a lignosulfonate solution by itself.

The results obtained above were compared to the results obtained where a wax-lignosul-fonate emulsion was used. In the run where wax emulsion was used, the wax content of the emulsion was about 47 weight percent. The lignosulfonate solution contained about 50 % solids.

In preparation of the wax-lignosulfonate emulsion the wax emulsion used above and the lignosulfonate solution described above were used. It was prepared by mixing 20 % by weight of the wax emulsion with 80 % of the lignosulfonate solution.

Since the solids of the lignosulfonate solution (a fermented calcium base spent sulfite liquor) contained about 80 % lignosulfonate, the wax content of the mixture was about 24 weight percent of the total wax and lignosulfonate solids in the mixture. Tests were also made using oak with and without the above additive (Table 1).

Table 1. The results obtained in the test runs

Run, #	Hard-wood type	Average moisture content, %	Additive	Amount additive, %	Average production rate, kg/hour	Average durability, %
1	Beech	14.1	-	-	600	94.5
1.1	Beech	13.8	starch	1	690	95.5
1.2	Beech	14.2	lignosulfonate solution	1	760	96.5
1.3	Beech	14.5	wax-lignosulfonate emulsion	1	800	93.8
2	Beech	12.5	-	-	480	90.5
2.1	Beech	12.4	starch	3	560	93.5
2.2	Beech	12.8	lignosulfonate solution	3	620	94.5
2.3	Beech	12.3	wax-lignosulfonate emulsion	3	650	92.8
3	Oak	13.8	-	-	800	92.5
3.1	Oak	14.2	starch	1	850	93.5
3.2	Oak	13.9	lignosulfonate solution	1	860	94.5
3.3	Oak	13.6	wax-lignosulfonate emulsion	1	880	92.6

Conclusions.

Treating the particulate hardwood with a starch, wax and lignosulfonate, increase the production capacity of the pelleting mill with a reduction in power costs, as well as obtaining an improvement in the durability of the pellets and reduces production costs.

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УДК 674.8 ***Ст. викл. Р.Р. Курка – НЛТУ України***

Дослідження впливу модифікаторів на процес гранулювання відходів деревини листяних порід

Досліджено вплив модифікаторів – крохмалю, воску та лінгосульфонатів на процес гранулювання подрібненої деревини листяних порід.

Ключові слова: прес-гранулятор, дерев'яні гранули, частинки твердих листяних порід.

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FUZZY INFERENCE SYSTEM FOR LUMBER CROSS CUTTING PROCESS MODELING

The hierarchic structure of factors, which influence on the scheme selection of cross cutting of lumbers into blanks, is provided. The model of the cross cutting process of lumbers is developed on the basis of fuzzy expert system. The possibility of using methods of fuzzy set theory for the solution of rational cross cutting is shown.

Keywords: lumber cross cutting, blank, defectless sections, cross cutting scheme, fuzzy expert system, linguistic variable.

Introduction. The cross cutting of lumbers into blanks is the important technologic operation, which has a considerable influence on the efficiency of wood working industry. The problem solution of products output (on the value and volumetric basis) with minimal raw material expenses may be the topical criteria of the efficiency of cut-out process of lumbers into blanks. It is appropriate to implement the searching of rational version of cross cutting process with account taken of main factors: measured and qualitative characteristics of lumbers and blanks, methods, ways and schemes of lumbers cross cutting, available type of equipment, parameters of workshop and importance of valuable indices in the products output – ways of wood waste usage.

The limitedness of wood stocks and its high value that forms 70 % of production costs impels to the immediate solution of tasks which will give an opportunity to secure the rational usage of wood. It is appropriate to consider the searching of rational version (method, way, scheme) of lumbers cross cutting into blanks one of the immediate tasks since output of blanks from lumbers may range mainly from 10 % to 90 %.

Thus, problem of searching the rational version of lumbers cross cutting into blanks is topical and for its solution it is important to develop effective ways of acceptance of current, efficient decision immediately in the process of real cross cutting.

Literature Review. Significant research work which concerns the problem solution of rational cross cutting of lumbers into blanks is conducted in the sawmilling technology. The research work of cross cutting of lumbers into blanks are mainly aimed at determination of blanks output, optimization of cross cutting and establishment of the effective usage of that or other version of cross cutting process for specific conditions of production according to their results [1-7]. Aiming at prognostication of blanks output the scientists use three main trends of research.

The first trend envisages conducting of theoretic research, the results of which permit to prognosticate only volumetric output of blanks [1]. The second trend envis-