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**Datasheet for the decision  
of 28 June 2013**

**Case Number:** T 1195/07 - 3.3.05

**Application Number:** 96933516.5

**Publication Number:** 853602

**IPC:** C04B 40/02, C04B 18/04

**Language of the proceedings:** EN

**Title of invention:**  
Hazardous waste treatment

**Applicant:**  
University of Greenwich

**Headword:**  
-

**Relevant legal provisions:**  
EPC Art. 54, 56, 84, 123(2)

**Keyword:**  
"Main request - allowable"  
"Clarity (yes)"  
"Novelty (yes)"  
"Inventive step (yes) - problem derivable from the description  
- no hints towards the solution in the prior art"

**Decisions cited:**  
-

**Catchword:**  
-



Case Number: T 1195/07 - 3.3.05

**D E C I S I O N**  
of the Technical Board of Appeal 3.3.05  
of 28 June 2013

**Appellant:** University of Greenwich  
(Applicant) 30 Park Row  
Greenwich, London SE10 9LS (GB)

**Representative:** Brookes Batchellor LLP  
46 Chancery Lane  
London WC2A 1JE (GB)

**Decision under appeal:** Decision of the Examining Division of the  
European Patent Office posted 1 March 2007  
refusing European application No. 96933516.5  
pursuant to Article 97(2) EPC.

**Composition of the Board:**

**Chairman:** G. Raths  
**Members:** G. Glod  
P. Guntz

## **Summary of Facts and Submissions**

- I. The present appeal lies from the decision of the examining division to refuse the European patent application EP 96 933 516.5.
- II. During the examination procedure the following documents were cited:
- D1: EP-A-0 367 914  
D2: DE-A-1 947 363.
- III. The examining division considered that claim 1 of the main request did not fulfil the requirements of Article 54 EPC. D1 disclosed a method according to claim 1 since the curing/hardening was accelerated by addition of carbon dioxide to form calcium carbonate when slaked lime was used as the binder. The auxiliary request was not admitted into the procedure under Rule 86(3) EPC 1973.
- IV. The applicant's (hereinafter: the appellant) notice of appeal and the grounds of appeal were received on 1 May 2007 and 29 June 2007, respectively.
- V. On 6 March 2013, the appellant was summoned to oral proceedings scheduled for 28 June 2013. In the provisional non-binding opinion accompanying the summons under Article 15(1) RPBA, the Board raised objections under Articles 123(2), 84 and 54 EPC. It considered that the functional definition "sufficient carbon dioxide to react...so as to produce a solidified waste or soil composition" might lack clarity, since the borderline between solidified and not solidified

was not clear to the skilled person so that he did not know when he was working within and when outside the scope of the claim. D1 was found to be relevant to the question of novelty. In addition the board indicated that the appellant should be prepared to discuss inventive step, if necessary.

- VI. By letter of 28 May 2013, the appellant submitted a new main request and auxiliary requests 1 to 6.
- VII. Oral proceedings took place on 28 June 2013. During the oral proceedings the appellant submitted a new main request. Articles 123(2), 84, 54 and 56 EPC were discussed.
- VIII. The appellant's arguments submitted in writing and during the oral proceedings can be summarised as follows:

Claim 1 was unambiguously derivable from original claim 1 in combination with original claims 6-7; page 6, lines 22 and 30 to 35; page 9, penultimate line and Tables 14-15. The expression "prime reagent" gave the sentence the meaning that the carbon dioxide was the main reagent to react with calcium.

The technical teaching of D1 confined itself to the addition of carbon dioxide to lime as a binder. Claim 1, however, required the addition of hydraulic cement. Carbonation upon the use of hydraulic cement as a binder was not disclosed in D1. Carbon dioxide could not be considered as prime reagent in the process of D1 and there was no disclosure of a carbon dioxide atmosphere in D1.

The process according to claim 1 led to stronger agglomerates that were less prone to leaching and would result in much faster reaction times. D1 did not teach the skilled person to use carbon dioxide with cement. As indicated in Table 15 more calcite was produced in a carbon dioxide atmosphere, which led to enhanced metals fixation.

IX. Requests:

The appellant requested that the decision under appeal be set aside and a patent be granted on the basis of the main request submitted during oral proceedings on 28 June 2013 or of the first to sixth auxiliary requests, submitted by letter of 28 May 2013.

X. Claims 1 and 2 of the main request read as follows:

*"1. A method of solidifying a waste or soil composition containing at least one contaminant species comprising one or more metal ions which comprises adding hydraulic cement and optionally water to said composition, mixing the cement and any optional water into the waste or soil material to form a mixture and during or after formation of the mixture, treating the mixture in a carbon dioxide atmosphere with carbon dioxide as the prime reagent to react with calcium in the mixture to form calcium carbonate which achieves setting and subsequent hardening of said mixture."*

*"2. A method as claimed in claim 1 wherein the waste or soil composition has been pretreated with gaseous carbon dioxide prior to formation of the admixture so*

*that one or more of its components have been carbonated by carbon dioxide prior to formation of said mixture."*

## **Reasons for the Decision**

### Main request

1. Article 123(2) EPC

1.1 The first part of claim 1 is unambiguously derivable from original claim 1 in combination with original claim 7.

That hydraulic cement is a preferred binder can be unambiguously derived from page 5, line 20 and page 6, lines 19-20.

The second part of the claim, which relates to the reaction with carbon dioxide, can be unambiguously derived from page 4, lines 5-9, where it is indicated that accelerated carbonation provides the basis of the invention. Accelerated carbonation is explained on page 26, lines 28-34, as the combination of carbon dioxide gas with calcium to form calcium carbonate which causes hardening and setting. Carbon dioxide is the prime reagent in the process (page 6, line 22). It is unambiguously derivable from the examples (see page 9, penultimate line; page 10, lines 3-4; page 15, line 4; page 18, lines 8-10; page 22, line 19 and Tables 14 and 15) that a preferred way of adding carbon dioxide to the cement-waste mixture is to work in a carbon dioxide atmosphere. In this context it should be noted that it is unambiguous from the examples that

carbon dioxide atmosphere and carbon dioxide environment are used as synonyms in the application. This preferred way of adding carbon dioxide gas is not inextricably linked to other features of the examples, since a carbon dioxide atmosphere can be used for the carbonation reaction independently of the composition of the mixture cement-waste (provided that calcium is present in said mixture).

Consequently, the Board comes to the conclusion that the subject-matter of claim 1 is unambiguously derivable from the original application.

Claim 2 relates to a preferred embodiment of claim 1. On page 33, lines 19-21, it is clarified that carbonation of the waste prior to the addition of the binders may be useful. Claim 2 is therefore considered to be unambiguously derivable from original claims 2 and 3 in combination with page 33, lines 19-21.

The requirements of Article 123(2) EPC are fulfilled.

2. Article 84 EPC

Claim 1 is interpreted such that it relates to a method of solidifying a waste or soil composition. This implies that after the execution of the process the waste or soil composition is less liquid than before.

The process steps are interpreted as:

- mixing the waste or soil composition that contains at least one contaminant species that comprises one or more metal ions with hydraulic cement and,

- treating said cement-waste mixture in an atmosphere made of carbon dioxide so that the calcium present in the mixture reacts mainly with carbon dioxide to give calcium carbonate that hardens the mixture.

The expression "prime reagent" is considered clear since it implies that calcium mainly reacts with carbon dioxide. It follows that the main reaction is the carbonation reaction and not the hydration.

The requirements of Article 84 EPC are met.

### 3. Article 54 EPC

- 3.1 D1 discloses a process for the production of leaching-resistant agglomerates from waste materials such as incinerator ashes or filter dust comprising heavy metals (claims 1 and 17).

D1 further discloses that cement and/or lime may be used as binders (see claim 9 and page 3, line 38). Mixtures of both are of interest, especially if the particle distribution of the waste material is unfavourable (see page 3, lines 43-45).

D1 explicitly discloses that the agglomerates should be hardened prior to transportation. If lime is used as the binder, the addition of carbon dioxide can accelerate the hardening process. The hardening of colloidal cement occurs through chemical reactions that are commonly known for cements (see page 4, lines 15-20).



If lime is used as a binder and/or a filler, carbon dioxide could also be used to help the hardening process (see page 4, lines 36-37).

It is the understanding of the board that the use of lime as a filler probably implies that cement was used as a binder.

The reaction of carbon dioxide with lime, possibly in the presence of cement, is thus unambiguously derivable from D1.

However, it is also unambiguous from D1 that the reaction of carbon dioxide is taught only with lime and not with cement. In view of the duration of the hardening given in D1 (see page 4, lines 40-41), it cannot be unambiguously derived that carbon dioxide is the prime reagent, since accelerated carbonation is a fast process (see, for example, page 22, lines 26-27 of the application). It seems rather that, if a mixture of lime and cement was used in the process of D1, carbonation and hydration would occur simultaneously.

Furthermore, D1 does not disclose that a mixture of cement and waste is reacted in a carbon dioxide atmosphere.

Therefore, the subject-matter of independent claim 1 and dependent claim 2 is not unambiguously derivable from D1.

The requirements of Article 54 EPC are fulfilled.

4. Article 56 EPC

4.1 The invention concerns a process for treating difficult or environmentally hazardous wastes by solidification prior to landfill (see page 2, penultimate paragraph).

4.2 D1 can be considered the closest prior art since it also relates to the solidification of waste (see 3.1).

4.3 As to the problem underlying the patent application in the light of D1, usually the problem as defined in the application is taken into consideration. However, as the description does not refer explicitly to such a problem, the problem is defined in the terms the appellant used during oral proceedings and which find a basis in the description. The problem is derivable from the description and can be defined as enhancing the properties of the cement-solidified waste (see page 34, lines 19-21) and thus reducing leaching (see page 6, two last lines).

4.4 As a solution to the problem the application proposes a method according to claim 1 characterised in that the cement-waste mixture is treated in a carbon dioxide atmosphere.

4.5 As to the success of the proposed solution, the board notes the following: in the carbon dioxide atmosphere, the solidification was very rapid (see page 22, lines 25-27) and led to a product that had mostly better strength than the product obtained under a nitrogen atmosphere or under normal atmospheric conditions (see Table 14 and figures 1 to 4). In addition, the leaching of copper, zinc, arsenic and chromium was reduced in

the product obtained through reaction in a carbon dioxide atmosphere (see figures 5-8). So it is accepted that the problem is solved plausibly. There is no need to reformulate the problem defined under point 4.3 in the light of D1.

- 4.6 It remains to be decided whether the proposed solution is obvious or not.

D1 does not teach the accelerated carbonation of cement. As already explained under point 3.1, D1 only discloses the carbonation of lime. The examples of D1 disclose the reaction of cement with a waste material wherein the agglomeration occurs via hydration (see boxes "*Beispiel 1*" and "*Beispiel 2*" on page 5 of D1).

D1 is silent with respect to a possible reaction of carbon dioxide with cement and also with respect to any possible advantage linked to that carbonation reaction. The skilled person does not find any guidance in D1 with respect to the problem underlying the present invention.

The other document cited during the examination procedure (D2) does not disclose cement as a binder so that the skilled person trying to enhance the properties of cement-solidified waste would not find any teaching towards the proposed solution in D2.

The board therefore concludes that the solution to the problem is not obvious in the light of the prior art.

The requirements of Article 56 EPC are met.

5. In conclusion, the subject-matter of claims 1 and 2 of the main request fulfils the requirements of the EPC.

Auxiliary requests 1 to 6

6. Since the claims of the main request are considered to fulfil the requirements of the EPC, there is no need to consider the hierarchically lower auxiliary requests.

**Order**

**For these reasons it is decided that:**

1. The decision under appeal is set aside.
2. The case is remitted to the department of first instance with the order to grant a patent based on claims 1 and 2 of the main request submitted during oral proceedings of 28 June 2013 and an adapted description.

The Registrar

The Chairman

C. Vodz

G. Rath