Preface

We would like to present, with great pleasure, the inaugural volume-7, Issue-11, November 2021, of a scholarly journal, *International Journal of Engineering Research & Science*. This journal is part of the AD Publications series *in the field of Engineering, Mathematics, Physics, Chemistry and science Research Development*, and is devoted to the gamut of Engineering and Science issues, from theoretical aspects to application-dependent studies and the validation of emerging technologies.

This journal was envisioned and founded to represent the growing needs of Engineering and Science as an emerging and increasingly vital field, now widely recognized as an integral part of scientific and technical investigations. Its mission is to become a voice of the Engineering and Science community, addressing researchers and practitioners in below areas

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Neural Networks	Plastic Engineering

Each article in this issue provides an example of a concrete industrial application or a case study of the presented methodology to amplify the impact of the contribution. We are very thankful to everybody within that community who supported the idea of creating a new Research with IJOER. We are certain that this issue will be followed by many others, reporting new developments in the Engineering and Science field. This issue would not have been possible without the great support of the Reviewer, Editorial Board members and also with our Advisory Board Members, and we would like to express our sincere thanks to all of them. We would also like to express our gratitude to the editorial staff of AD Publications, who supported us at every stage of the project. It is our hope that this fine collection of articles will be a valuable resource for *IJOER* readers and will stimulate further research into the vibrant area of Engineering and Science Research.

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Table of Contents

Volume-7, Issue-11, November 2021

Equations of Thermodinamics for Expansion and Filling by Human Civilization

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Abstract— *Civilization of people is presented as a thermodynamic nonequilibrium system with all types of human activity including the territory of residence. The main types and aspects of human's activity are presented as thermo dynamic energies or extensials, and their derivatives as the speed of their development or intensials. Territories of peoples' residence are presented as hierarchies of areas or volumes of the thermodynamic nonequilibrium system. The representation of states or their unions in the form of thermodynamic models of nonequilibrium systems with their equations and taking into account the hierarchy of their sub-territories that give a possibility to calculate and avoid wars, revolutions, pandemics in certain states, unions of states and continents. Separately, given an group of equations for taking into account the relations of individuals in society, their consumer basket, an increasing or decreasing in the population of people living in a given territory. Thermodynamic nonequilibrium models and equations have been applied for expansion and filling by civilization of new territories and transition her to a new level.*

Keywords— *civilization, thermodynamic, nonequilibrium system, hierarchy of territorial structures.*

I. INTRODUCTION

Until now, there are no calculational methods for predicting and developing intelligent life on Earth and on other planets. Evaluation of the prediction of local and major wars, epidemics, taking into account the current codivirus pandemic, lack of food and water, environmental and man-made impacts on the human population on Earth are more than actual. The target of present work is performance of civilization as a thermodynamic nonequilibrium system with all aspects of the present and past human's activity. Thermodynamic nonequilibrium system laws and basic equations are applied for descriptions, development, expansion and filling by civilization and transition her to new progressive level. The main types and aspects of human's activity are presented as thermo dynamic energies or extensials, and their derivatives as the speed of their development or intensials. Territories of peoples' residence are presented as hierarchies of areas or volumes of the thermodynamic nonequilibrium system. The representation of states or their unions in the form of thermodynamic models of nonequilibrium systems with their equations and taking into account the hierarchy of their sub-territories that give a possibility to calculate and avoid wars, revolutions, pandemics in certain states, unions of states and continents. Separately, given an group of equations for taking into account the relations of individuals in society, their consumer basket, an increasing or decreasing in the population of people living in a given territory. The equations are programmed into numerical methods and can be useful for analysis by power structures as in particular country so in international organizations of the United Nations.

II. PROBLEM FORMULATION

The life of people population that live in certain territory, or state, or union of states or territories can be representing as nature phenomenon of various interactions. Under interactions we will to understand all energies, produced and accumulated by static or kinetic energies or work of human population. She creates different types of energies of existence and interactions. Thermodynamically, can also be called it a functionals. [1-4] Thermodynamically, civilization as system can be to describe as thermodynamic nonequilibrium system. The life of an animal population in a certain territory already has its own biological laws. They can be designated as thermodynamic and apply to people as well. The life of human civilization is much wider than the animal population and affects various aspects of human life (state, business, history, culture, creation of

means of production, language, traditions, religion, art and much more) All this can be described thermodynamically as energy and work of creation by man. The thermodynamic equations bring us closer to common understanding of the development and filling by civilizations in certain territories in the form states, territorial and union associations. The thermodinamical equations can also be used for determining of the directions development and filling by civilizations. Mathematical analysis allows us to understand in advance what is happening with population of people in territory on which they live. This allows avoiding the wars, revolutions, as well as pandemics.

III.   RESULTS AND DISCUSSION

3.1   Equation 1: The civilization as thermodynamic nonequilibrium or equilibrium system

The thermodynamic nonequilibrium system has behavioral interactions of energies or functionals, civilizational aspirations, democratization of business, human rights and freedoms, rule of law, economy as a function of the state, state structure, political parties, territory, borders, linguistic, religious, cultural, historical, community, traditions, etc. However, the main types of behavioral interactions or functionals of the people population are includes: (1) historical extensial (traditions, language, culture, songs, dances, religion, marriage, relationships in the family, parenting, traditions of despotism or democracy, climate, food consumption chain, food-producing skills), economic functional (the state and forms of economic relations in society, country); (2) state functional (the structure of state and political system, the structure of the courts, the law enforcement system, the police, the army); (3) religious functionals (the population of people living in a given territory has that religion, philosophy or does not have one that is close to her in mentality); as well as (4) territorial extensial: the territory or its parts in which the human population lives for a certain period of time. There may also be other extensions of the population of people living in a given area. The functionals can have the sub functionals, for example, historical functional can have such sub functionals on sub territory also: traditions, language, culture, songs, dances, religion, marriage, relationships in the family, traditions of despotism or democracy, climate, food consumption chain, food procurement skills, and others. Each functional or sub functional has its intensity for certain period of time. The author name it the functional as is customary in the thermodynamics of nonequilibrium systems.

3.2   Equation 2: Thermodynamics of the cyclical native of civilization in certain territory and in space time interval.

Civilization develops with increasing freedom of human intelligence and the growth of production means production for serving of civilization. Such a center is Western Europe. She give a cyclical reproduction of new level civilization in Western Europe and these people that all the time creates a new type of civilization according to the following law:

$$g = aW1 / 4 \tag{1}$$

Where, g is the average time cycle of the reproduction of civilization in this territory; a referring to constant number; and W is the average size of the consumer basket. The periodicity of the time interval human population in this territory or the territory of state associations is subject to the Fibonacci number series.

3.3   Equation 3: Thermodynamics of initiation to new model of civilization for certain territory.

For understanding on how civilization is changing, introduction to coefficient A of the thermodynamic condition nonequilibrium system for people population of living in certain territory, and also introduce the reciprocal of the coefficient A and call it the capacity of the thermodynamic condition system.

$$K = 1 / A = dE / P; A = 1 / K \tag{2}$$

Where, A refer to the coefficient of the thermodynamic condition nonequilibrium system for people population of living in certain territory; E is the extensional of the behavioral condition; P is the territory area; as well as K is the capacity of the thermodynamic nonequilibrium system for people population of living in this territory. The capacity of the thermodynamic condition system is numerically equal to the thermodynamic energy of the thermodynamic nonequilibrium system of population people of living in certain territory, which changes the functional by one. For example, the produced amount of GDP, $d\Psi$, the derivative of the manufactured products and services and its cost price $d\varphi$, are interconnected by the following, resulting from Eq. (1).

$$K = (d\Psi / d\varphi) \, \Phi \tag{3}$$

Where, Φ refer as the area for this sub-extension; as well as the A which refer to the coefficient of the thermodynamic condition of the state is the reciprocal of the state capacity and has directly opposite properties, that is ability of the

nonequilibrium system to withstand the influence filling from other states and civilizations. According to Eq. (1) and (2), then higher the capacitance K, the more thermodynamic energy must be brought to this territory of people population, so that the coefficient A increases functional by 1. This outcome are exactly the same approach is applicable for other extensions (Historical, economic, state, religious and others) and their sub-extensions.

3.4   Equation 4: Thermodynamics of the development territories.

The thermodynamics of the change for one hierarchy territories to another occurs when the thermodynamic condition changes with any extensional. With this effect, at first, change any functional of the subterritories, and then change all hierarchy ensembles of subterritories. The thermodynamic condition becomes to equilibrium for certain period of time as for this functional as and by territorial extensional also. For some states, such square territorial functional may be quite long. Changes of i functional as territories of structural units of state, regions, or provinces for 2 functional or their sub functional have the form:

$$P_1 = f_1 (E_1 , E_2)$$
$$P_2 = f_2 (E_1 , E_2) \tag{4}$$

Differentiating among the equation, absolutely the outcome will be:

$$dP_1 = A_{11} dE_1 + A_{11} d E_2$$
$$dP_2 = A_{12} dE_1 + A_{12} d E_2 \tag{5}$$

The state coefficient of the state nonequilibrium system A connects the functional and intensials, when changing from one nonequilibrium state to another, coefficient A changes. Obviously, the coefficient of state is also a measure of the quality or structure of state territory or unit of state's territory, province, region, region, territorial community. There are simple and cross-sectional coefficients of connections between singles structures of state and interactions of structures under territories state with the center. Basic and cross coefficients A in the form of corresponding functions of various functionals E:

$$A_{11} = f_{11} (E_1, E_2)$$
$$A_{12} = f_{12} (E_1, E_2)$$
$$A_{21} = f_{21} (E_1, E_2)$$
$$A_{22} = f_{22} (E_1, E_2) \tag{6}$$

The author limited on the testing to 2 functionals, and apply the differentiation, that to show the capacitive characteristics of 2 functionals:

$$dA_{11} = B_{111}dE_1 + B_{112}dE_2$$
$$dA_{12} = B_{121}dE_1 + B_{122}dE_2$$
$$dA_{11} = B_{211}dE_1 + B_{212}dE_2$$
$$dA_{11} = B_{221}dE_1 + B_{222}dE_2 \tag{7}$$

When it changes take place under the influence of which functionals then can change territory parts for thermodynamic nonequilibrium condition system of the state. These changes can affect in all territory of this state and it can then enter some another territory parts in another thermodynamic condition state. Otherwise, under the influence of other functionals these territory parts can leave this state and become to another equilibrium thermodynamic condition of the state, but without these territory parts with other interactions of functionals that are not characteristic of the former thermodynamic system of this state. It can be said that in territory parts influence hostile functionals to this state that it demonstrate an asymmetry of ensemble structures territory parts and has the form a nonequilibrium thermodynamic system. After the influence of some extensions, territory parts again can demonstrate symmetry of ensemble structures territory parts and the state become to equilibrium thermodynamic condition system of the state again. However, some territorial parts may retain the asymmetry of ensembles of territorial parts or it can be a nonequilibrium thermodynamic system of territorial parts and can enter in another state. After the entry of these territorial parts, another state also passes from a nonequilibrium thermodynamic condition system to an equilibrium one with symmetry of ensembles of structures territorial parts of its own state.

3.5   Equation 5: Thermodynamics of the influence of human well-being or consumer basket on the people population density in certain territory.

A group of equations for the people population living in given territory depending from consumer basket, increasing, decreasing of the population size, depending from various conditions, the behavior of individuals in the population also shows how the density of people population that correlates with wealth or consumer basket.

$$d = aW\text{-}3/4 \tag{8}$$

Where, d is the average population density in certain territory, A refer to the constant number, and W is the average size of the consumer basket. According to this law, those people that has most size of the consumer basket usually has and more lower average population density, or rather, the average population density decreases with increasing of the size consumer basket increase at proportion to approximately equal to the consumer basket in degree ¾ [5].

3.6   Equation 6: Thermodynamics of the influence consumer basket on the formation person for ensuring quality of life.

This law shows how the formation person connect with consumer basket in according with grow and achieve adulthood formation and as correlates with the size of the consumer person basket in certain territory. It says that people population with larger size of the consumer basket that the period of personality formation is usually longer. The period of formation increases with increasing of the size consumer basket in proportion to the value of approximately equal to the consumer basket in degree ¼ [6] (Body weight in this law is mass during the reproductive period as animal population). The law for the period of personality formation is expressed by the following allometric equation [7]:

$$r = aW\text{-}1/4 \tag{9}$$

Where, r is the level of natural growth inherent in the state people population, A refer to the constant number, and W is the average size of the consumer basket.

3.7   Equation 7: Thermodynamics of interactions 2 competitive groups of state territory for gravitating to other thermodynamic centres of states or union of states.

The Lotka-Volterra model considers 2-3 groups of people population of with different behavioral interactions in certain territory, gravitating to different types of thermodinamical state system [8]. In mathematical form, the proposed system of equations has the following form:

$$dx/dt = (\alpha - \beta y)x$$
$$dy/dt = (-\gamma + \delta\ x)y \tag{10}$$

Where, x is the number of citizens of type 1, y is the number of citizens of type 2, and t is the time, alpha, beta, gamma, as well as delta are coefficients that reflect interactions between communities of different citizens. These are interactions of various functionals or their sub functionals with negative feedbacks connections. An example of negative feedback connections can be increasing of consumer basket and this may cause restrictive measures from the state. But, this can reduce the civilization development: due to deterioration of the investment climate, the growth of constraints and the vertical of power.

3.8   Equation 8: The thermodynamics of the cyclical growth of people population in this territory depends from consumer basket size.

It says that for people population in certain territory with larger sizes of consumer basket, the cycles of population reproduction less. The length of the reproduction cycle increases along with consumer basket and in proportion to value equal to approximately the consumer basket in degree ¼ [9]:

$$t = aW1 / 4 \tag{11}$$

Where, t is the average duration of reproduction cycle, A refer to the constant number, and W is the average value of consumer basket.

3.9   Equation 9: Thermodynamics of the reproduction people population.

It is proportional to the amount of available resources, analogous to the law for animal population. The rate of reproduction people population is proportional to amount of available resources. Thus, second member of the equation reflects competition at resources, which limits population growth in this territory.

dP/dt=rP(1-P/K)   (12)

Where, P is the number of people population, t is the time, r is the parameter or reproduction growth, K is the reproducing power of environment for maximum possible of population size.

The mechanisms of the within civilizational struggle people population intensify with increasing population density. Subsequently, it limits the growth of civilization people population with aggression within civilization. These mechanisms are activated with increasing population density, because individuals tend to occupy a space, which is currently not enough for everyone. The individuals protects own civilizational space and all of them are required to look for the necessary or basic space resources [10]. Other factors usually limit people population before than its density will increase before offensive of mechanisms of interethnic struggle.

3.10   Equation 10: Thermodynamics of the growth and decreasing people population in certain territory change exponentially without transition to another level.

The civilization of people population is growing exponentially without transition to new level. Malthusian law [11] describes how populations grow or decreasing in according with this level of civilization when nothing else happens. It describes the natural condition of populations or when nothing else.

3.11   Equation 11: Thermodynamics of increasing number people population with increasing the ability of civilization to survive.

There is a positive relationship between individual adaptability to living conditions and the number or density of people in this territory. With increasing of the ability population to survive and civilizational ability could also be increase, for examples can be any Empire, the Soviet Union, the European Union, and NATO. According to Allé's law, [12] there is decrease reproduction or survival ability of populations with decreasing density of civilization.

IV.   CONCLUSION

In this paper, the basis has been developed for representing civilization as a thermodynamic no equilibrium system. The thermodynamic characteristics of the people's life and activity are introduced as functionals and their derivatives, intensials, hierarchies of the sub territories of living there people. Also, the concept of a thermodynamic nonequilibrium system for the state and alliances of states is introduced. Not to mention, the laws of thermodynamics of nonequilibrium systems and their biological analogues of animal populations are applied for the development, expansion and filling of civilization.

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Therapeutic applications of tincture at 10 % from *Calendula officinalis* in Recurrent Aphthous Stomatitis

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Abstract— *A study about the use of medications (indication-prescription) was realized, prospective in patients with buccal illness, using a tincture at 10 % from Calendula officinalis as therapeutic option, in four different clinics in Havana City, Cuba. 110 patients were chosen randomly, and were collected data from 60 physicians. Results were measured as treatment-response, time of improvement and used dosis with time of improvement. The sample answered to the treatment at 90 %, and from them, 73.7 % in a period between 3-6 days, and 26.3 % in a period of 7-10 days. Calendula officinalis tincture at 10 % was effective in treatment of buccal infections corroborating its antibacterial and anti-inflammatories properties due to the presence of volatile oils, and flavonoids, among others.*

Keywords— *Calendula officinalis, Recurrent Aphthous Stomatitis, tincture at 10 %, treatment, dosis.*

I. INTRODUCTION

Oral cavity is the entry gate of foods, vitamins, liquids, medications and other that has introducing into the organism. Oral infections are one of the most frequent causes found out in medical practice. Aphtha or buccal ulcers are injuries that appear in oral mucous, when its localization is located to the mouth and not like a consequence of some systemic illness, receiving the name of recurrent aphthous stomatitis (RAS). Probably, an immunological dysfunction jointed to diverse unchain factors facilitate aphtha appearance. That local immunological dysfunction will be related with an increase of lymphocytes T populations (CD4 and CD8) and an increase of α-TNF (Herrera et al., 2015; Cui et al., 2016).

One of most representative periodontal illness by its frequency and symptomatology is recurrent aphthous stomatitis (RAS), which constitute one of stemmatological infections that require immediate attention due to the provoke inconveniences at patients. Affect both sex, but principally female sex in any age, even though is more frequent in teenager associated to risk factors like stress, gastrointestinal disorders, microorganisms (virus, bacteria, fungus), smoke habit, traumatism, psychosomatic and immunity alterations, endocrine factors, nutritional deficiency, allergy, and a hereditary component (González & Montero, 2013; Pérez & Rodríguez, 2006; Solís et al., 2017).

Recurrent aphthous stomatitis (RAS) is one of the most common painful oral mucosal conditions seen among patients. These present as recurrent, multiple, small, round, or ovoid ulcers, with circumscribed margins, having yellow or gray floors and are surrounded by erythematous haloes, present first in childhood or adolescence (Jurge et al., 2006). RAS is characterized by recurrent bouts of solitary or multiple shallow painful ulcers, at intervals of few months to few days in patients who are otherwise well (Scully & Porter, 2008).

RAS has been described under three different clinical variants as classified by Stanley in 1972:

1. Minor RAS is also known as Miculiz's aphthae or mild aphthous ulcers. It is the most common variant, constituting 80% of RAS. Ulcers vary from 8 to 10 mm in size.

2. Major RAS is also known as periadenitis mucosa necrotic recurrent or Sutton's disease. It affects about 10–15% of patients. Ulcers exceed 1 cm in diameter.

3. Herpetiform ulceration is characterized by recurrent crops of multiple ulcers; may be up to 100 in number. These are small in size, measure 2–3 mm in diameter.

Treatments are pharmacological principally, and consist in diminishing symptoms and avoid secondary infections. Using topic anesthetics (lidocaine 10 %), collusive (sodium perborate, chlorhexidine 0,2 %) and phytotherapy (calendula, chamomile, *Plantago mayor*, aloe), propollis, honey, homeopathy, laser therapy, acupuncture, digit puncture, etc. Analgesics and anti-inflammatory agents, topic antivirals and steroids, vitamins, systemic antifungals, or antibiotics are commonly used (Zhu et al., 2010; Nolan et al., 2006).

Various predisposing factors are associated with RAS, among them, Genetic predisposition, Trauma, Tobacco, Drugs, Hematinic deficiency, Gluten sensitive enteropathy/celiac disease, Inflammatory bowel disease, Sodium lauryl sulfate-containing toothpaste, Hormonal changes, and Stress (Gallo et al., 2009).

Several microorganisms have been implicated in the pathogenesis of RAS. Several contrary findings have been reported in the various studies published. Among them, are oral streptococci (*Streptococcus mitis*); *Helicobacter pylori*; Viruses (human cytomegalovirus DNA (HCMV); Epstein-barr virus (EBV)) (Sun et al., 1998). Tumor necrosis factor alpha (TNF-α) is a pro-inflammatory cytokine and is one of the most important cytokine implied in the development of new aphthous ulcers in patients (Jacobson et al., 1998; Zabel et al., 1993).

Calendula officinalis L. (Asteraceae), commonly known as caléndula, copetuda, botón de oro, corona del rey, flor de difuntos, rosa de muertos, maravilla, marigold, etc., was the plant used to elaborate the tincture at 10%. Being the flowers its useful organ. Their name derived from Latin word *calendae*, which mean calendar (Enríquez et al., 2010; Hernández et al., 2011).

Native from Egypt, cultivate in Europe in XII century, widespread later to the rest of the World. In Mediterranean region, it grows easily during the Summer in British Islands, and enjoy with great reputation like ornamental plant farming in courtyards, gardens and gavels. Cultivated in Europe since XVII century, specifically in England and ten countries more, among them: Germany, Spain, France, Hungary, Poland, Romania, Switzerland and Russia. Was introduced in Kuwait, Japan, Mexico, Combia, Costa Rica and USA. The date of introduction in Cuba remains unknown, although is very recognized as wreath padded and to give atmosphere to avenues and parks (Lastra & Piquet, 1999; MINSAP, 2002).

Floral stubborn or ligulae flowers (Figure 1) are broadly used for its anti-inflammatory, spasmodic, sedative, sudorific, vulnerary and bactericide properties against *Staphylococcus aureus* and *Staphylococcus faecalis*. In inner applications is recommended to stimulate the hepatic activity and because of biliary secretion, treatment of gastric ulcerations. In external application, decoctions, tinctures and ointments are employed in mask, varicose ulcers, and cutaneous eruptions. Infusions are informed as ant ulcerous, and to the treatment of skin affections (García, 2017).

The aim of this research was to evaluate the affectivity of treatments with a tincture of calendula at 10 % in diagnostic patients with RAS in stemmatological clinics in Centro Habana Municipality in Havana, Cuba.

FIGURE 1: Flowers of *Calendula officinalis*.

II.   MATERIALS AND METHODS

2.1   Context

The research was developed in 4 stemmatological clinics from Centro Habana Municipality in 2017, with a total of 45 armchair attended by 65 stemmatologists. The annual average incidence in Centro Habana Municipality is around 200 patients (Dept. Registros Médicos, 2018).

2.2   Classification and Methodology

A retrospective, longitudinal and descriptive study of utilization form of tincture of calendula at 10 % in RAS was designed. With the objective of known the information that the stemmatologists about the tincture an interview was realized to all personal (56) that consent their participation on the research, considering criteria of some authors (ULP, 2016; Larios, 2016).

2.3   Universe, Sample and Criteria

Universe was constituted by 180 patients with diagnosed RAS. Having into account the selection criteria, 110 patients were selected (sample). The criteria selection was: Clinic History, both sex, older than 18 years, and RAS diagnose. Clinic History with not all information or illegible writing was discarded.

Three different objectives were included into the questionnaire to the specialists: 1. Knowledge about medicinal properties of *Calendula officinalis*, 2. Knowledge about medical indications of tincture at 10 % f *C. officinalis*, and 3. Knowledge about the efficacy of this therapy in stemmatological affections. Answers were valorized according to the following criteria: Adequate knowledge; Middle adequate knowledge and Inadequate knowledge.

2.4   Socio demographic and clinic characterization of patients with RAS

For socio demographic and clinic characterization of patients with RAS, the variables used were:

Age: 19-29 years old; 30-39; 40-49; 50-59; 60-69; 70-79; 80 and more than that.

Gender: Male or Female.

Toxic habits: smoker; nonsmoker; ex-smoker; without references.

Alcohol: drinker; nondrinker; ex-drinker; without references.

Kind of RAS: according the classification given by Scully and Porter, 2008: Minors, Majors, Herpetiform.

Frequency of RAS: Casual RAS; Acute RAS; Recurrent RAS; Without references.

2.5   Wound evolution in time with the treatment of the tincture

Each patient was orientated verbal and in writing to purchase the tincture in the pharmacy, way of application (topically), Do not ingest any food until 1 hour after the application, go to consultation every 48 hours until improvement or change of treatment.

Days of treatment with the tincture: between 3-6 days; between 7-10 days.

Administration frequency: 3 times per day.

Dosage: 5 drops/100 mL of water; 10 drops/100 mL of water.

Treatment's response: cured/ satisfactory: all symptoms disappear after 10 days; not cured/ unsatisfied: symptoms not disappear after 10 days.

Effectiveness index of treatments:

Was calculated by $Effectiveness = \frac{Cured\ patients}{Total\ patients} \times 100$

Effective: effectiveness equal or higher than 90%

Half effective: effectiveness between 80-89%

No effective: effectiveness less than 79%

2.6   Ethical considerations

Research was done taking into account the Helsinki's Declaration, 2013. Protocol was submitting under consideration and approval of Master's Academic Committee and requesting the approval of the Clinic and Policlinic Administration. Investigating made a compromise of confidentiality about patient's identity, just like the data used to realize this study. All specialists involved in the research were asked about their consent to participate in the investigation.

2.7   Analysis and processing of the results

Data base was making in Microsoft Excel including all variables and categories. Calculation of percentage and absolute figures were expressed in tables and imagine facilitating the analysis and discussion. Statistical processing was done using the SPSS. 22 Window's package.

2.8   Research's limitation

Because of the research was a retrospective investigation being able to find slanting of information.

III.   RESULTS AND DISCUSSIONS

3.1   Identification of information degree of specialists about the therapy with calendula tincture at 10%.

Table 1 shows the number of armchairs and sex of specialists interviewed by each clinic under study. Clinic "Enrique Sainz Casado" own the biggest amount of armchairs due to its exclusivity for stemmatological attention. As it can see, female gender is predominating among the stemmatologists. 56 specialists gave their consent to participate in the research, representing 86.2 % of the whole in Centro Habana Municipality, being a thoroughly representative value to validate their answers.

TABLE 1
ARMCHAIR NUMBER AND SPECIALIST'S COMPOSITION ACCORDING TO SEX INTERVIEWED IN CENTRO HABANA MUNICIPALITY

| Place of stemmatological attention	Number of armchairs	Specialists		
		Females	Males	Total
Policlinic "Luis Galván Soca"	11	13	1	14
Policlinic "Joaquín Albarrán"	9	6	4	10
Policlinic "NGuyen Van Troi"	11	10	0	10
Clinic "Enrique Sainz Casado"	14	20	2	22
Total	45	49	7	56

56 specialists answered properly question 1 whose objective was to identify the knowledge about the medicinal properties of *C. officinalis*. Correct answer is that recognize the anticoagulant, anti-inflammatory, antiseptic, antibacterial and antiemetic activities of the plant. Taking into account their answers, we consider the consciousness adequate.

Question 2 had six possibilities to replay about indications of tincture at 10% of calendula in stomatology. Only four of them where properly answered, as is shown in Figure 2, qualified as Middle Adequate Knowledge.
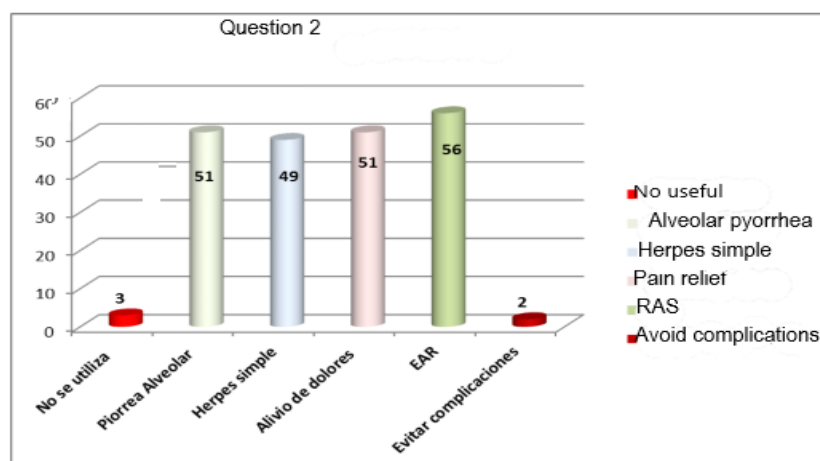
FIGURE 2: Results after question 2.

Figure 3 show the answers given by the specialists at question 3, related with the criteria about the effectiveness of treatment using that therapy in stemmatological affections. It is evident that 11 specialists' unknown or consider unsatisfied the effectiveness of this therapy, classifying as unsuitable knowledge.
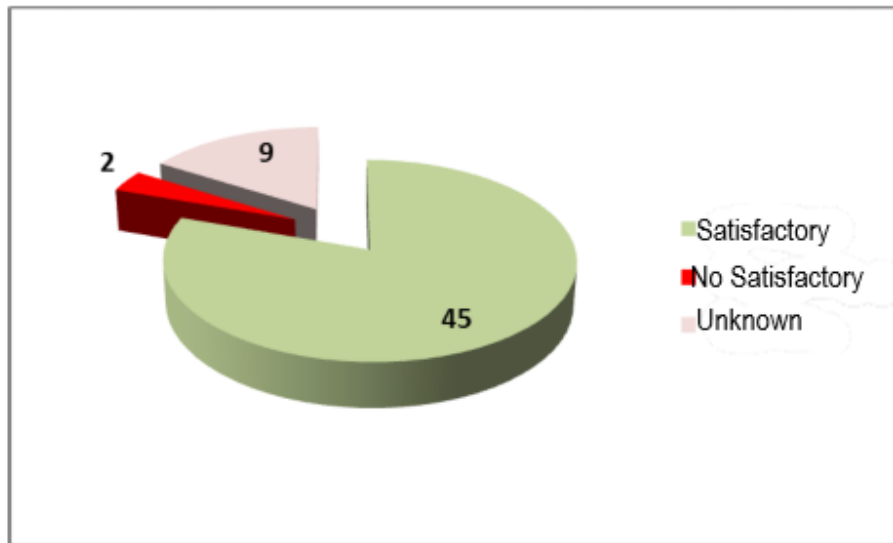
FIGURE 3: Obtained results in question 3.

Table 2 show the global results about the valuation of knowledge degree of specialists. The specialists hold knowledge about the medical properties of *C. officinalis*, however, 11 answered negatively about the effectiveness of the treatment using this therapy in stemmatological affections, indicating the ignorance of the term effectiveness, regarding the design an investigation to determine the cause of this result. Because of the fact that they do not trust in the effectiveness of the treatment in some stemmatological pathologies, confine its prescription.

TABLE 2
VALUATION OF KNOWLEDGE DEGREE OF THE SPECIALISTS ABOUT THE USE OF TINCTURE AT 10% OF *C. OFFICINALIS*

Question No.	Specialists with correct answer	Qualification
1	56	Adequate knowledge
2	52	Middle adequate knowledge
3	45	Inadequate knowledge
Final qualification		Middle adequate knowledge

Three decades ago, WHO be carried out a calling to the Governments and International Community with the end to incorporate in Health National Systems the use of traditional therapies and alternative medications. Cuba, has trace general rules of acting in view of the immediate and mediate future. One of them, demand maximum attention to improve the natural and traditional medicine.

3.2   Sociodemographic and clinic characterization of patients with RAS

Table 3 relates the group of ages and sex of the 110 patients with RAS selected in the research because they fulfill the established selection criteria. Female sex with 60 patients and ages between 30-50 years old in both sex prevailed. Consulted literature confirm the overrule of female sex and middle ages with RAS, associated to active labor life and the increment of stress by this fact, appearing gastrointestinal problems, immunological and nutritional deficiencies, among others, coinciding with our results (Morales & Ventura, 2000).

TABLE 3
SAMPLE COMPOSITION WITH RAS, AGES AND SEX TREATED WITH TINCTURE AT 10%

| Age	Female	%	Male	%	Total	%
19-29	1	1.6	2	5	3	2.6
30-39	17	28.3	11	22.9	28	25.3
40-49	15	25	14	23.2	29	26.3
50-59	9	15	11	22.9	20	18.1
60-69	7	11.7	4	9	11	9.9
70-79	7	11.7	5	11	12	10.9
80 and more	4	6.7	3	6	7	6.9
Total	60	54.5	50	45.5	110	100

Recent studies establish a similar situation in Morocco, where the 60% of patients are females (Rodríguez & Raissouni, 2018). In Cuba, there are references of realized studies in Las Tunas Province and Moron Municipality with 65.5 % and 65.8 %, respectively (Díaz et al., 2018; Báez et al., 2015).

Recent epidemiologic studies indicate that the prevalence of RAS fluctuate between 2-50 % in general population, with a total estimated between 5-25 %. Average age is 19-20 years old, and its presence has not relation with geographic location or race. There is a prudent prevalence in female sex, although many authors point out that there are not significant differences between one group and any other (Pacho & Piñol, 2005).

Diverse research report that in patients with RAS exist an important deficit of certain nutritional elements (Casiglia, 2002). Inside of lacking elements we can find the deficit of folic acid, vitamin C, vitamins B12 and B1, minerals like iron, zinc, and calcium, and states of hypoproteinemia (Haisraeli-Shalish et al., 1996).

Some report indicate that some patients have certain hyper sensibility to certain foods, such as celiac illness, whom have an intolerance to gluten and other alimentary allergy (Sedghizadeh et al., 2002). Nevertheless, the results are still controversial in Turkey, because at the end of the research the levels of vitamin B12 were low significantly in patients with RAS comparing with control normal fellows. They concluded that the deficit of vit B12 is an important factor in genesis of RAS (Ogura et al., 2001).

Some investigations mention smoke habit as an unchaining factor in RAS. Figure 4 represent the composition of the sample taking into account the presence or not of smoke habit.
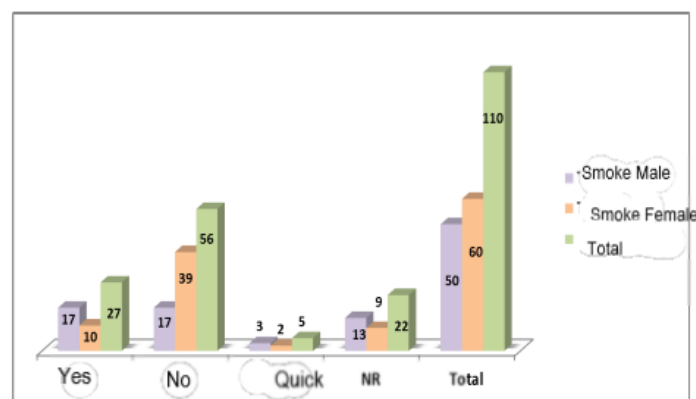
FIGURE 4: Patients with RAS with Smoke habits.

24.5 % of patients (27) smoke actually, coinciding with the result of Risk National Factor Survey that said that 27.3 % older than 15 years are smokers. So that, 31.1 % are males and 16.4 % are females, coinciding with obtained result, where exist a prevalence of masculine gender (17) and seven patients were smokers, being smoke habit, even it has stop, a defined risk factor to appearance the RAS (Edgar et al., 2017).

Only one male patient is a drinker, while a female patient leaves to drink or is considered ex-drinker. This result has not coincidence with National Survey of risk factors in transferable diseases (Pacho and Piñol, 2005), where was reported the prevalence of 41.7 %, from them, 71.9 % were males, while the groups of ages between 25-34 and 35-44 years' old have the

higher presence. Be a drinker is not a risk factor to unchain the illness but, malnutrition and immunologic deficit constitute a risk by themselves.

Table 4 shows the kind of RAS considering the size of ulcer and its relationship with tobacco habit according to Scully and Porter.

TABLE 4
PATIENTS COMPOSITION WITH RAS ATTEND TO KIND OF RAS AND TOBACCO HABIT

Kind of aphtha	Smoker	No Smoker	Ex-Smoker	Without reference	Total
Minor	11	43	1	13	68
Major	9	6	1	1	27
Herpetiform	7	7	3	8	35
Total	27	56	5	22	110

Obviously, minor aphtha is predominant, associated to no-smoker patients. In the case of herpetiform, appear at the same time in smoker patients and no-smoker patients, and on three of the five ex-smoker patients. Authors like Tamayo Ortíz and Scully & Porter, publicized similar results with the apparition of minor aphtha.

Tobacco is not an unchain factor, but it can complicate the established periodontal pathology. Investigation indicates that smokers from both sex have a high prevalence of gingivitis and chronical destructive periodontitis, among others. Table 5 summarized the appearance frequency of aphtha according to the sex.

TABLE 5
PATIENTS WITH RAS TAKING INTO ACCOUNT SEX AND APPEARANCE FREQUENCY.

Frequency	Female	Male	Total
Occasional aphtha	39	21	60
Acute aphtha	11	18	29
Recurrent aphtha	9	9	18
Without reference	1	2	3
Total	60	50	110

Occasional aphtha is the most represented where lesions are isolated, intervals of appearance fluctuate between months and years, but lesions heal up without obstacle. In the case of acute aphtha episode can persist during weeks, appearance the lesions in different zones of the mouth, replacing aphtha in way of healing or cured, commonly in children or adults with acute gastrointestinal dysfunctions that remit when improve the gastrointestinal dysfunction. There are 18 patients with recurrent aphthae, where affections be possible to continue months or years, there is a lesion present always, and more difficult to get well (Morales & Ventura, 2000).

3.3   Evaluation of effectiveness of treatment of RAS with tincture of calendula at 10 %

Days of treatments with the tincture of calendula at 10 % are represented in Figure 5. From whole patients, 86 of them using the tincture between 3-6 days, and 24 patients between 7-10 days. Among them, 18 patients classify as recurrent aphtha, which is known to be the most arduous to respond to any therapy (Jiménez & Rivera, 2017).
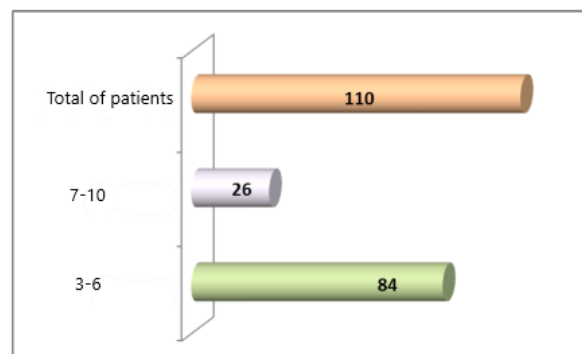
FIGURE 5. Response in time to the treatment of RAS with tincture at 10 %.

Obviously, exist a prevalence of patients with positive answer to the treatment between 3-6 days. In the sample under study had a prevalence of patients with occasional aphtha, reason why it could be influenced on high effectiveness of the treatment with calendula at 10 % deal with small and a little complicate lesions.

Table 6 summarizes the distribution of patients according to dosage and frequency of administration of tincture from calendula at 10 %.

TABLE 6
RESPONSE TO THE TREATMENT OF RAS WITH TINCTURE OF CALENDULA AT 10 %.

| Dosage and frequency of administration	Patients		Days of treatments			
	Amount	%	3-6	%	7-10	%
5 drops/100 mL 3 times per day	49	44.5	45	53.6	7	26.9
10 drops/100 mL 3 times per day	61	55.5	39	46.4	19	73.1
Total	110	100.0	84	100.0	26	100.0

Clinical history reported that whole patients were administrated three times per day, being 55.5 % the patients using 10 drops/100 mL of water, and 73.1% with a treatment for a time between 7-10 days. Those results are in correspondence with those realized at the University of Nayarit using calendula in the scaring in oral cavity in post extraction of third molar, in patients treated with mother tincture of *C. officinalis* (Hernández et al., 2009).

Similar results were demonstrated by Sagué et al., 2010, in stemmatological clinic "José Luis Tassende" in Santiago de Cuba, where was demonstrated the efficacy of the tincture at 20% of *C. officinalis* in stomatitis subprotesis grade I, as much as palate like superior alveolar edge, through a therapeutic clinic assay phase II randomized and monocentric.

The research done by Fang et al., 2013, at the Odontology University of Cartagena, Colombia, pose that oral rinsing with calendula, allow the opportune healing of tissues from post-surgery gingival mucosa; medication with this plant, contemplates a little proportion of antimicrobial capacity and a high inductive ability on tissue healing.

Ojeda et al., 2007; Lima et al., 2011 and Tamayo et al., 2019, reporting similar results related with the days of treatments, only with a little difference in the case of Ojeda, related with the fact that the most used posology was 5 drops/100 mL of water. The treated sample under study (110 patients) answered in a 90 % in a period of 3-6 days (73.7 %), and 7-10 days (26.3 %), respectively.

Figure 6 summarized the answer at the treatment with tested patients, where only 11 patients not healing because the symptoms not dissolve at 10 days, and 4 of them, was realized a change in the treatment.
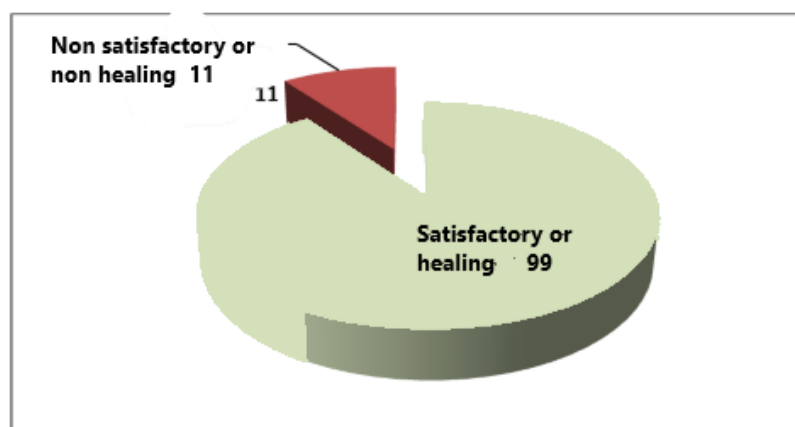
FIGURE 6: Treatment response with tincture at 10 % of *C. officinalis*.

Similar results were obtained by Roveroni et al., 2009 in patients with RAS under topical treatment with tincture at 10 % against exfoliative cheilitis. Treatment of chronic gingivitis in Higher Institute of Medical Sciences in Villa Clara Province, Cuba, obtained satisfactory results in spite of it is another pathology, but, calendula has healing properties in optimal treatment (Veitía et al., 1998).

Result of the estimate of effectiveness index to the 90 % of applied treatment had a high coincidence with several authors in Centro Habana Municipality, as is shown in Figure 7. It was different if the study had been designed towards fulfillment of therapy.
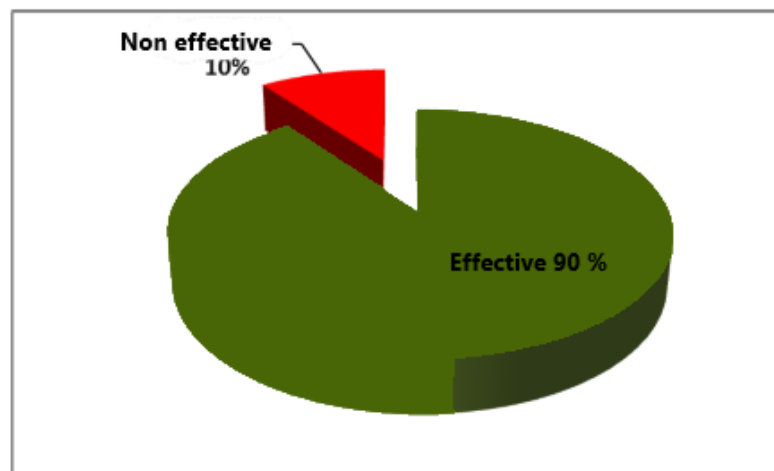
FIGURE 7. Effectiveness index of treatment with tincture at 10 % of *C. officinalis*.

Aphthous lesions are, generally, benign and present auto imitated evolution. By this reason, it is not available a specific treatment that cure them and are treat in palliative manner. In our country, there is a great experience in natural and traditional medicine, where rules have been created to the use of phyto medication and bee medication, recommended to use in treatment of RAS, like aloe, calendula, etc., all of them with anti inflammatory and cicatrizing activities.

Sometimes, oral erosions disguise the first signals of a heterogeneous group of diseases such as Behçet illness, Crohn illness, celiquism, or hematological alterations like agranulocytosis. There are denominate aphthous lesions and present an accompanying symptomatology, regarding to consult a physician immediately.

IV. CONCLUSIONS

Information degree of interviewed stemmatologist about the use of calendula's tincture at 10 % was qualified as middle adequate knowledge. Female sex predominated in patients with RAS as well as ages between 30-59 years' old. Predominant RAS was of minor type (54.5 %), followed by herpetiform (22.7 %). Treatment of lesions in time with tincture of calendula at 10 % result between 3-6 days, fundamentally with a posology of 5 drops/100 mL of water, with the 90 % of patients cured before the 10 days of initialized the therapy. Effectiveness of therapy with tincture at 10 % of calendula was evaluated in a 90 % of whole cases. Authors recommend designing effectiveness or efficacy tests in a clinic and aleatory assay, to demonstrate the definitive efficacy of tincture of *C. officinalis* in this one and other stemmatological affections.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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Design of Passive Cooling Module for Metalhydride Vessel for Hydrogen Storage

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Abstract— *The article addresses the design and calculation of heat transfer in the program ANSYS CFX of passive cooling module for metal hydride low-pressure vessels, which main purpose is to store hydrogen used in mobile applications such as automobile or bus.*

***Keywords**— Heat exchanger, heat transfer, Hydrogen, hydrogen storage, metalhydride vessel.*

I. INTRODUCTION

Hydrogen is most abundant element not just on earth but also in the universe and has very promising future as an energy carrier. The largest amount of hydrogen is of course bound in water and hydrocarbons. Hydrogen has a low bulk density, so it contains a relatively small amount of energy. To work with hydrogen several challenges must be addressed. First challenge is hydrogen production, second is distribution and third is storage. This article addresses the challenge of storage. Most abundant way of storing a hydrogen is by using high-pressure vessels, next is by using cryogenic vessels and lastly there is hydrogen storage in low-pressure vessels by absorbing hydrogen into metal alloy structure. Hydrogen storage in metal hydrides represents the possibility of storage in low pressures as well as in low temperatures. Used metalhydride in our vessel is based on elements La Ce Ni. The only disadvantage is low thermal conductivity of metallic alloys and generated heat from hydrogen storage. Since there is generated heat by hydrogen storage in low-pressure vessels, passive and active cooling modules must be present. This article solves the problem of implementing passive cooling module into low-pressure vessel.

II. HYDROGEN STORAGE IN METAL HYDRIDES

Storing hydrogen in form of solids with formation of metal hydrides (intermetallic and complex hydrides) is a very attractive technology for safe and efficient way of storage. Metal hydrides have much higher density than in comparing with liquid or gaseous storage. Hydrogen storage in metal hydrides is based on the properties of some metals, which can absorb hydrogen atoms into their metal lattice. Also, due to the relatively low operating pressures, solid state hydrogen storage is considered a relatively safe technique.

III. DESIGN OF METAL HYDRIDE VESSEL

The design of the metalhydride low-pressure vessel must be created according to standard STN EN 13322-2. Name of mentioned standard is „Transport gas cylinders, design and production of refillable steel gas cylinders ". Created vessel consist of two parts which are primary body and casing system for the flow of coolant and heating fluid as can be seen in Fig 1.
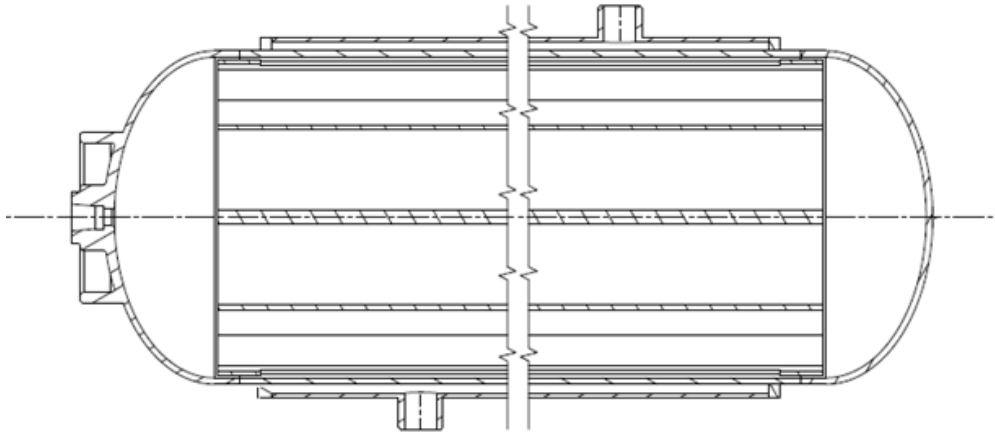
FIGURE 1: Design of low-pressure vessel

Stainless steel 1.4404 316L with parameters shown in Table 1 was chosen for the construction of the vessel.

TABLE 1
MECHANICAL PROPERTIES OF STAINLESS STEEL 1.4404 316L

0,2% Re (MPa)	Rm (MPa)	ρ (kg·m^{-3})	μ	E(MPa)
200	500-700	8000	0.3	$2.1 \cdot 10^5$

IV.   CONSTRUCTION DESIGN OG PASSIVE COOLING MODULE

A heat transfer intensifier is inserted into the vessel. This intensifier is made from aluminium and serves as passive cooling module. The main role of intensifier is to increase dissipation of heat from the core of the vessel to the shell, where the vessel is cooled by active cooling module. The intensifier inside of the pressure vessel is shown on FIGURE 2. By changing the geometry of heat exchanger, we can intensify the heat removal from the storage and thus improve the process of hydrogen absorption into the structure of metallic alloy. When designing passive cooling modules, the condition that the ratio of metal hydride storage capacity to aluminium volume is maintained must be considered. The intensifier is best made of aluminium due to its good thermal conductivity ($\lambda = 237$ W.m^{-1}.K^{-1}).
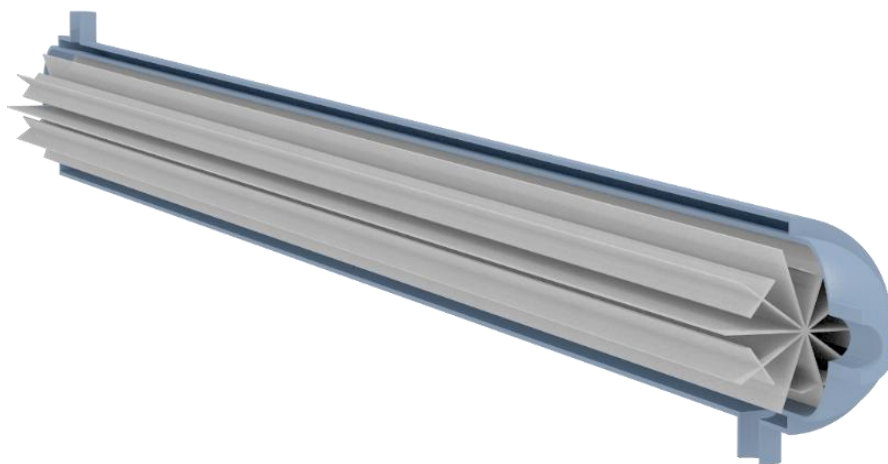
FIGURE 2: Internal heat exchanger inside of metal hydride vessel

Figure 3 shows the design of the geometry of the internal heat exchanger in its cross section. This geometry consists of 8 primary lamellas and 8 secondary lamellae. The secondary lamellas are connected to 4 main ribs. Auxiliary lamellas are placed every 45°. The gap between the intensifier and the shell wall is 1 mm.
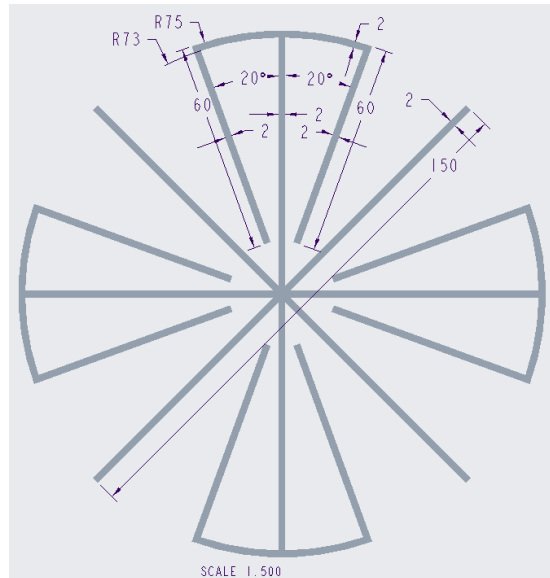
FIGURE 3: Cross-section of internal heat exchanger

V. HEAT TRANSFER ANALYSIS OF DESIGNED INTERNAL HEAT EXCHANGER

This chapter describes simulations by using finite element method by using program called ANSYS CFX. Numerical solution by using finite element method of such problems is currently the most efficient. Solving problems that involve se

Numerical solution using finite element method of such problems is currently the most efficient and universal way. Solving problems that involve complex and difficult geometry with different materialistic properties is impossible to solve analytically. The finite element method is used to solve problems in the field of fluid flow and heat transfer. The method is based on that the examined model is divided into finite number of volumes and subsequent calculation takes place over the boundary points of these volumes.

The simulations are focused on heat dissipation from the core of the metal hydride pressure vessel. Heat dissipation by means of a coolant along the outer surface of the casing is also investigated. All simulations are solved in ANSYS CFX program as 2D tasks.

The internal heat exchanger design is made from fourteen lamellas, where the four main lamellas are connected by eight secondary lamellas near the wall of the pressure vessel. The other four auxiliary lamellas are spaced by 45°from each main lamella.

Next step of setting up simulation is to create domains and boundary conditions that will affect the final calculation. First boundary condition is that the pressure vessel is cooled around the primary pressure vessel where metal hydride is located by temperature of 20°C and has flow speed of 0.3m·s^{-1}. On the outlet of cooling liquid, we considered the temperature of approximately 22°C. Heat transfer coefficient between the vessel and cooling liquid was calculated to simplify the final calculation. Next boundary condition was to set up materialistic properties of used metal hydride material (Ti Fe) in simulation and those are:

- Molar weight – 62,55 kg·kmol^{-1},

- Bulk density – 3250 kg·m^{3},

- Specific heat capacity – 430 J·kg^{-1}·K^{-1},

- Thermal conductivity– 1 W·m^{-1}·K^{-1}.

Time of the filling of the vessel is 1200s.

In figure 4 is cross-section temperature field in the pressure vessel. The maximum temperature by metal hydride during the simulation is 93.34°C. The created temperature field shows that the metal hydride is overheated in 4 spots between main lamellas and auxiliary lamellas which makes them not efficient enough. At the beginning of the simulation according to the

course of maximum temperature (Figure 5), temperature rises rapidly and gradually stabilized towards the end of simulation. The course of minimum temperature from the middle of the simulation is linear.
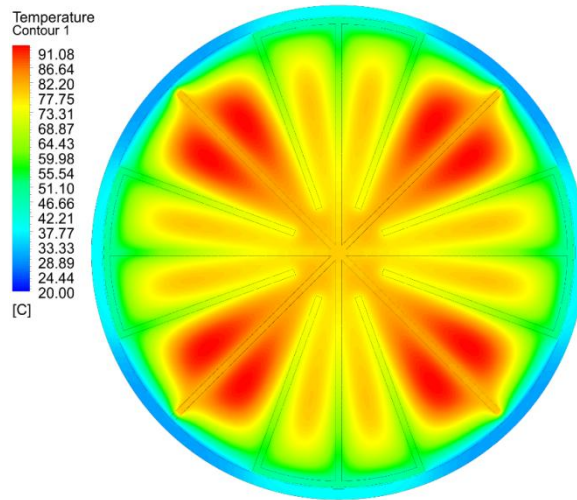

**FIGURE 4: Cross-section temperature field of the pressure vessel**
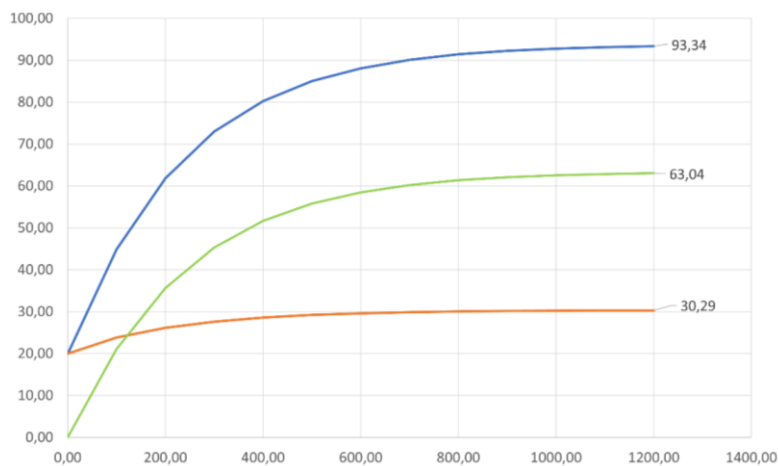
FIGURE 5: Maximum (blue) and minimum (orange) vessel temperatures courses and ΔT course (green)

The heat dissipation by cooling the metal hydride vessel in this simulation is shown in Figure 6. From the results of this simulation auxiliary ribs do not dissipate heat efficiently. The largest amount of heat is removed from the storage in the places of the main lamellas.
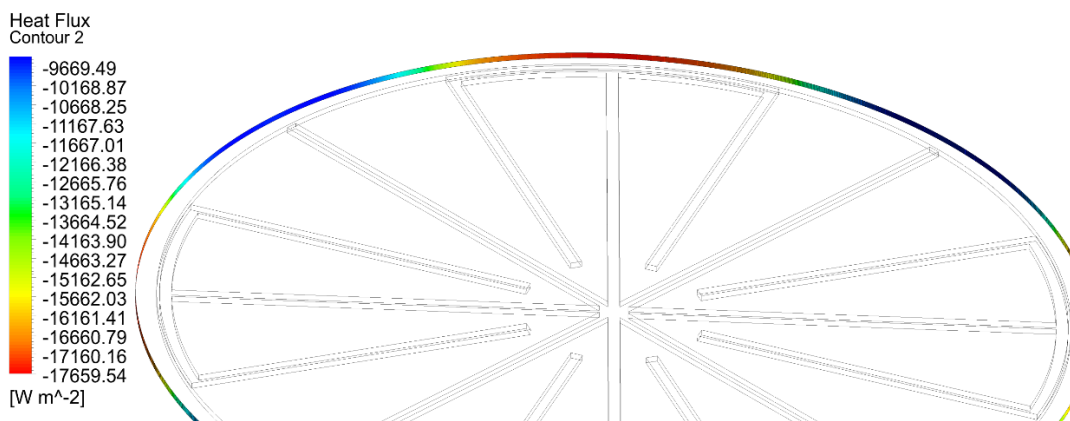
FIGURE 6: Heat dissipation by cooling

The cooling power that we can see in the picture has the largest value at the end of the simulation and its value is 6.76 W. This power is calculated per 1 mm of model thickness.
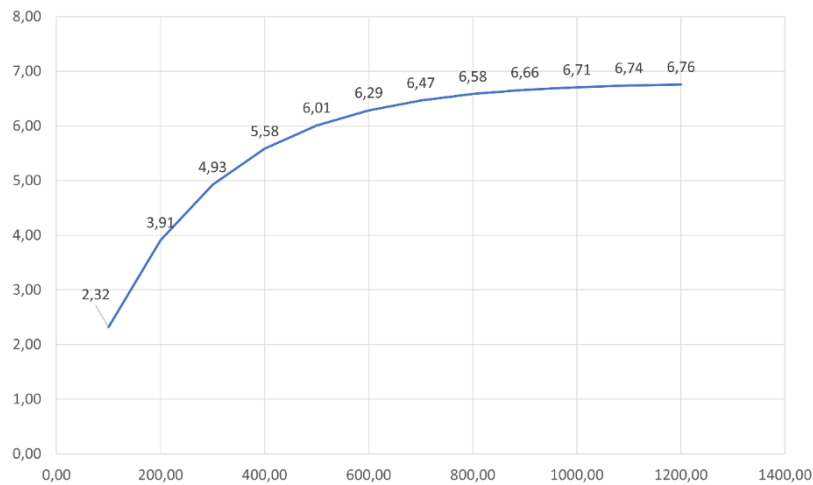
FIGURE 7: Course of cooling power over time

VI.   CONCLUSION

Storing hydrogen in metal hydrides present very promising future since high pressures are not required. Only disadvantage of storing hydrogen in metal hydrides is requirement of heat dissipation, which is generated by metal hydride absorbing hydrogen. This is the main reason why active and passive cooling systems needs to be provided to the metal hydride pressure vessel. This article shows the design of passive cooling system implemented in metal hydride pressure vessel and heat transfer calculation. The results shows that auxiliary ribs do not dissipate heat efficiently which means, that metalhydride is overheated in those places. To get more satisfactory results, geometry of heat transfer exchanger needs to be changed. For instance, the placement of auxiliary lamellas can change the whole outcome of the simulation.

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