Report of the third meeting Valuxtract

February 6th, 2014 – Sofralab Compiègne France

List of participants:

Name	Partner	mail
Anne-Claire Silvestri	**EIC**	**anne-claire.silvestri@eichangins.ch**
Julien DUCRUET	**EIC**	**julien.ducruet@eichangins.ch**
Jean-Philippe BURDET	**EIC**	**jean-philippe.burdet@eichangins.ch**
Rainer JUNG	**GEI**	**rainer.Jung@hs-gm.de**
Christoph Schuessler	**GEI**	**christoph.schuessler@hs-gm.de**
Hermann MORAST	**GEI**	**hermann.Morast@mail.hs-gm.de**
Sébastien MANTEAU	**SME Sofralab**	**smanteau@sofralab.com**
Christophe MORGE	**SME Sofralab**	**cmorge@sofralab.com**
Eugène Vorobiev	**UTC**	**Eugene.vorobiev@utc.fr**
Mohammad TURK	**ESCOM**	**m.turk@escom.fr**
Sylène BRIANCEAU	**UTC**	**sylene.brianceau@gmail.com**
Xavier VITRAC	**UBS (Phénobio)**	**xavier.vitrac@phenobio.fr**
Arnaud MASSOT	**UBS (Amarante)**	**arnaud.massot@u-bordeaux2.fr amaranteprocess@u-bordeaux2.fr**
Rémy GHIDOSSI	**UBS**	**remy.ghidossi@u-bordeaux2.fr**
Sami YAMMINE	**UBS**	**yammine.sami@gmail.com**
Martine MIETTON-PEUCHOT	**UBS**	**martine.mietton-peuchot@u-bordeaux2.fr**

General Assembly

- S.Manteau
- M.Turk
- E.Vorobiev
- J.P. Burdet
- R.Jung
- M.Mietton-Peuchot

The general assembly have analysed the different points for the report due on the 15th of April, the members should give the list of communications and publications that were done. Fill the:

- Hiring dates personnel recruited on fixed-term contracts
- Free comments from the other partners
- Percentage of financial status

1. Minutes of the first meeting

A review of the main point of the previous meetings, difficulties and objective were brought forward:

1. The quantification of the amount wood by-product being produced.
2. Define the different molecules and aromas that should be extracted.
3. Specification of the molecules that could be extracted and the quantities that could be produced for the years.
4. Defining the by-product formation.
5. Analysis and the methodology should be the same between Compiegne and Bordeaux.

First report

A report progress should be sent to ECO Innovera:
The first part is administrative (identification of the partners)
The second part the different tasks, work packages, and the current positioning (with the justification of the time needed)
The third part Progress report (10pages, 2 pages per partner before the end of march)
The forth part is the project valorization (publications, multi partner publication)

Review article

A multiple review was proposed between partners:

1. Review taking into consideration the quantification of the by-products and the usage of the extracts (EIC & Geisenheim).
2. Review concerning the extraction and the purification methods (UBS & UTC).

The outline of the articles should be discussed by the end of March.
First draft should be submitted before the next meeting in June.

Date and place of the next meeting

The next meeting will be held in Geisenheim on the 9-10 June 2014

Scientific Meeting

09.10: Presentation of Sofralab "Bibliographic review on … Valuxtract" – Sébastien MANTEAU

The aim of this work is to make a state of the art on the valorization of by-products of the vine and wine, point of industry professionals, patents and research .

a) Valuxtract ... : State of the Art

In France, the IFV (French Institute on Grapevine and Wine) worked on the markets for by-products of winemaking : 1- distillation of grape pomace , wine lees and lees , 2 - Spreading grape pomace , 3 - Composting grape pomace and 4 - methanation of grape pomace. In Spain, a research cluster is working on a Project to Reduce SO_2 from by-product.

In the EPO's databases , over 90 patents contain keywords and Grape Pomace.

And if in a search engine : such as ScienceDirect, if you use keywords as Grape Pomace and there almost 2 000 scientific articles ! Two thirds of GP references are on Health.

b) Focus on Some Publications

Some Publications are good reviews on :

- The extraction method

- Phenolic compounds and antioxidant activity

- Interesting opportunities as white microbiology, adsorption of undesirable compounds, wine fining or other industrial applications that we can target at the end of this project

c) Conclusion & Perspectives

- Research progresses quicker! It's important to be aware of this subject. …We are in the air…

- It's interesting to test the product... but also the waste!

- Microbiology grape pomace could be interesting for white (industrial) biotechnology.

- Deposits present at the bottom of wine tank after treatment with adjuvants (Coal, PVPP, bentonite, isinglass, etc. could be also very interesting raw material ...)

- Should not we get closer to other companies / research units to better promote our products?

I have Endnote file (.enl) or word (.doc) on the subject if you are interested? And a Zip file with Articles and Patents.

Important point of discussion during the meeting:

> M. Turk: Limits to take the applications on the scale. S. Manteau: Industrials are interested in polyphenols, fibers, proteins and polysaccharides (all colloids). A study of the economic part of the economic should be done. C. Morge: Finding alternatives to

SO_2 is an interesting topic, and might be a good idea to search for, or finding other product that could be helpful in the oenological domain. H. Morast: Extracts obtained improved mouth feel and color, but till now these are not legalized. R. Jung: We don't have to decide during the meeting what should we do with the extract. We should study the product for example for lowering SO2 or microbiological stabilization, or use of these extract as alternative to oenological tannins, and how they are produced. M. Turk: oenological tannins extraction is mainly based on solid liquid extraction, and purification is based on resin adsorption or liquid liquid purification. M. Mietton Peuchot: Proposed M. Turk if he could be a 15 min presentation concerning traditional extraction techniques in the next meeting.

09.30: Presentation of GEI – "Preliminary Sensory Studies using Dunkelfelder extract" – Hermann Morast

1. Threshold values using extract in red and white wine:

In this investigation the threshold value of Dunkelfelder extracts were evaluated by sensory methods. Therefore triangle tests were performed with red and white wine enriched with different amounts of extract.

a) Materials:

Extract made from Dunkelfelder pomace and filtered through a sterile filter (0,33 µm) was added to a German 2012 Red Wine blend (QbA, no oak) and a German 2012 Müller Thurgau (QbA).

b) Methods:

Up to 39 students from the Hochschule Geisenheim University participated in the sessions in December 2013 and January 2014. All panelists had previous sensory evaluation experience. Samples were tested in individual booths. White wine samples were tested under red light in order to eliminate any visible colour differences due to the red extract. Less than four triangle tests were performed at each session.

c) Main results:

Table 1 shows that there is a significant difference between the samples when there are added at least 400 mg/l extract to the red wine blend.

Table 1: Threshold value for the extract in added to the red wine blend is 400 mg/l

Added extract [mg/l] to wine	*n*	*Significant difference*
0 vs 200	*39*	*No*
0 vs 300	*30*	*No*
0 vs 400	*26*	*Yes (α= 0,05)*

The panelists found a significant difference between the pure wine and the enriched Müller-Thurgau at an added concentration of 200 mg/l as it is shown in table 2.

Table 2: Threshold value for the extract added to the Müller Thurgau is 200 mg/l

Added extract [mg/l] to wine	*n*	*Significant difference*
0 vs 150	*13*	*No*
0 vs 200	*18*	*Yes (α= 0,001)*
0 vs 300	*18*	*Yes (α= 0,001)*
0 vs 400	*10*	*Yes (α= 0,001)*

d) Conclusion:

The threshold value of extract added to white and red wine can be used as a fingerprint for how much extract is required for the storage studies. Furthermore the threshold value depends on the used wine (red, white, oak influence, residual sugar,…).

2. Impressions using Dunkelfelder extract

a) Adding colour to wine:

None of the available extracts can be used as a finishing agent in white wine. The addition causes a colour changing even when there is only a small amount added.

b) Extract production:

By comparing extracts produced by different process parameters it appears that there must be a difference in the composition of the extracts. It seems that the control extract has more ingredients than the others have. Moreover it seems like decreasing the pore size lowers the phenol content.

c) Storing conditions:

Storing soluted extract or with extract enriched wine under cold conditions might cause problems. Precipitation takes place even if the storing time in the fridge (6,5 °C) is less than one week. This effect appears to all extracts.

d) Solubility of powder:

Extract-powder is not completely soluble when it is added to wine under wine-cellar conditions. It might be useful to mill the extract in order to improve the solubility.

3. Future studies

Storage studies with wine will be performed as soon as there is enough extract produced. The studies should show how the chemical components change during maturation. Sensory studies will be operated, too.

In order to figure out if extracts can be used as a finishing agent wine samples will be bottled and analysed during a time frame of one year.

The usability of the extracts as a fining agent and the influence on chemical components will be evaluated in the 2014 harvest.

Please note: For further information concerning the requirements of the future studies, please refer to the enclosed presentation.

Important point of discussion during the meeting:

H. Morast: Immediate need of extract. How much could be supplied of the optimum extract? In what form powder or solution? Storage of the extracts parameters? And reference values? J.P. Burdet: Dunkelfelder has high anthocyanin but low tannin concentration. S. Yammine: But higher amounts of tannins were found in the extracts of Dunkelfelder. J.P. Burdet: But lower skin contact time was used in Dunkelfelder variety in comparison to other studied varieties. S. Yammine: Storage of the extracts was studied, and the best method was to store in dark dry place. M. Turk: On the industrial scale there is no use freeze-drying, instead usage of heat plus vacuum. S. Yammine: Roto-Evaporator was used in the lab for drying but we didn't not reach a powder state. S. Brianceau: On an industrial scale, freeze-drying is too expensive, and freeze-dried extracts is more sensitive to humidity. S. Yammine: This technique was chosen in order to standardize our work and makes them more comparable. M. Turk: Evaporation under vapor could lead to powder form if evaporated correctly and left for a longer time to dry. J. Ducruet: A solution may be to use a cream or the viscous extract obtained in our experiment. M. Mietton Peuchot: Expressing the results in standard manner is best done using the lyophilization technique. C. Morge: Anthocyanin in our extracts may cause legal problems in consideration of the extract as a finning agent. R. Jung: Standardization of the extraction process to take anthocyanins is important in order to obtain the highest amount. C. Morge: the problem is mainly the OIV rules and regulations. M. Mietton Peuchot: if we have something interesting we would present to it to the OIV in order to try to get it accepted. R. Jung: the aim of the project is to create something innovative even if no accepted by the OIV for the time being. S. Yammine: we have reached a powder extract by lowering the solvent content in the initial content. H. Morast: The quantities of the extracts needed will be discussed after words. Storage test and polyphenol analysis should be done.

10.15: Presentation of EIC – "Comparison of treatments to optimize storage of red grape pomace" – Anne-Claire Silvestri

a) Aim

To test storage conditions of red grape pomace
Conservation of the pomace over 6 months, easy to use, economical, ecological, available in an industrial context …

b) Materials and methods

Pomace from Cabernet Franc harvested in 2013

8 samples: Preservation at ambient temperature (AT) or 4°C, under aerobic or vacuum conditions, native or with treatment (SO_2+H_2PO_4)
5 measurements: after 2, 45, 90, 135 and 180 days of conservation

Analysis

- ✓ Organic acids and sugars (HPLV UV and RI)
- ✓ Microbial population (Plate count agar on selective medium)
- ✓ Color intensity (Sum of DO 420+520+620 nm)
- ✓ Polyphenol concentration (DO 280nm)
- ✓ DO 420/520 to monitor oxidation

c) Results after 45 days of conservation

No significant differences between treated (sulfited + acidified) pomace and not treated

Efficacy of the treatement ?

Not easy to quantify SO_2 in solid grape pomace

The samples conserved under aerobic conditions and at ambient temperature showed the following characteristics:

Lots of Drosophila
Development of molds and acetic bacteria in the pomace
High concentration of acetic acid and consumption of alcohol
Highest decrease of polyphenols
Highest oxidation

Development of lactic acid bacteria only under anaerobic conditions at AT or 4°C
Decrease or stabilization of anaerobic yeasts in all samples
Lowest decrease of polyphenol at 4°C under anaerobic conditions
The color decreased in each sample.

d) Conclusion

The chemical treatment didn't improve pomace stability.
The pomace drastically changed under aerobic condition and at ambient temperature.
Is it a problem ????
It is too early for any conclusion between 4°C and vacuum.

For more information please see the attached presentation "*Comparison of treatments to optimize storage of red grape pomace*"

Important point of discussion during the meeting:

H. Morast: What is the best method of presentation of total polyphenols in the presentation. A. C. Silvestri: the best method is defined per gram of dry wait and on the amount of water if the extract M. Turk: what was the fate chemical after the chemical treatment during storage. C. Silvestri: studying the SO_2 in the sample was very difficult due to the nature of the dry pomace. M. Mietton Peuchot: we should follow what could be applied on in the industrial scale. J. Ducruet: Putting by-products Nitrogen tanks maybe a feasible technique on the industrial scale.

J.P. Burdet: SO2 gas could be tested since it is found in wineries and could be preliminary method of storage.

11:00: Presentation of UTC "*Deployment of Response Surface Methodology to Optimize HVED-assisted Extraction of Grape Stems Polyphenols* presented" by Sylène Brianceau

a) ***Objectives:*** *The present work reports on the extraction behaviours of flavonoids from grape stems using high voltage electric discharges (HVED) as a green process to enhance the mass transfer phenomena.*

A 3^3-full factorial design approach was used to assess the effect of processing parameters: the solvent pH (X_1 = 2.5-8.5), the HVED treatment time (X_2 = 0-4 ms) and the % of ethanol (X_3 = 0-50 %). The combined effects of high voltage electric discharges (HVED) with the pH, as well as the solvent composition, on individual flavonoid behaviours, extractability and stability noticeably, during the extraction process are discussed.

b) ***Material:*** *Grape stems were obtained from Cabernet Franc cultivar (Vitis vinifera L.). Stems were collected after destemming of grapes, immediately dried and stored at room temperature until vacuum after processing. The dry matter of the stems was 88.3 ± 2.2 % and the particle size was between 0.3 mm and 2.0 mm.*

c) ***Methods:***

HVED pre-treatment: The HVED experiments were performed in a laboratory treatment chamber connected to a pulsed high-voltage power supply (Tomsk Polytechnic University, Russia). The treatment chamber was initially filled with dried grape stems (Cabernet Franc, Switzerland) (40.0 ± 0.1 g) and mixed with distilled water (liquid-to-solid ratio $R_{L/S}$ = 7.5, v/w). The desired pH was then obtained using 1N KOH and 1M HCl and the electrical discharges were then generated by electrical breakdown in water.

Extraction procedure: The subsequent diffusion was performed after adjustment of the final liquid-to-solid ratio at 15 by adding a mixture of ethanol and water, and adjustment of the pH using 1N KOH ($4.5.10^{-3}$ mol.L^{-1}) and 1M HCl ($3.0.10^{-2}$ mol.L^{-1}). A gentle agitation at 160 rpm was provided using a round incubator shaker (Infors HT Aerotron, Bottmingen, Switzerland) at 20°C, during 120 minutes.

Analysis of the response variables: The HPLC system used for individual flavonoids analysis was an Agilent 1200 HPLC Series (Agilent Technologies, Germany) equipped with a diode array

detector. A volume of 15 µl of diluted sample (1/2) was injected in a Prontosil C18AQ column (4,6×250mm, 5 µm, Bischoff Chromatography, Germany), operated at 25°C, in reverse phase. Solvent A, 0,1 % Trifluoroacetic acid (TFA) in water and solvent B, 0,1 % TFA in acetonitrile were used for elution at the flow rate of 1mL/min. The elution gradient had the following profile: t0 min B (7 %), t2 min B (7 %), t10 min B (16 %), t40 min B (31 %), t45 min B (50 %), t48 min B (70 %), t49 min B (100 %), t54 min B (100 %), t55 min B (7 %), t60 min B (7 %). The detection wavelengths were 280 nm (flavanols) and 370 nm (flavonols). Results were expressed as mg of catechin equivalents/L of solution for monomers of flavan-3-ols, g of procyanidin B2 equivalents/L of solution for oligomers of flavan-3-ols, and g of quercetin equivalent/L for flavonol compounds.

e) <u>Results:</u>

The experimental screening performed was designed to assess the influence of three factors; the pH (X_1 = 2.5-8.5), the HVED treatment time (X_2 = 0-4 ms) and the ethanol concentration (X_3 = 0-50 %), on the individual flavonoid behaviours. The experimental values of all indices, analyzed by multiple regressions to fit the second-order polynomial equations, can adequately predict the experimental results.

Flavonoids extraction was strongly affected by the concentration of ethanol added in the extraction solvent. For this specific flavonoid classe recovery, ethanol concentrations ranging from 40.0 and 50.0 % were the most satisfactory. The cell desintegration and product fragmentation induced by HVED enhance the ethanol transport into cells and thus lead to an increase of flavonoids recovery.

Catechin, the major monomer of flavan-3-ol compounds, and epicatechin are efficiently extracted at long HVED treatment time (4 ms), whereas optimal extraction for procyanidins B2 and B1 required lower effective time. Uppon longer treatment times, procyanidins B2 and B1 seem to be degradate by the process. Type-B procyanidins are dimers resulting from the condensation of two units of flavan-3-ols linked by bond between two carbons in the flavan units. However, this bond is relatively unstable and may be broken by different treatments such as acid catalysis or electrical treatment. In the case of HVED treatment, it suggests that the increase of monomeric flavan-3-ols may not only be due to the enhancement of mass transfer involved by the process. It may also be attributed to depolymerization phenomena of the dimers forms, and probably of complex molecules with higher numbers of flavan-3-ols units. When HVED was applied on grape stems suspension, a strong interaction of the pH with treatment time (X_1X_2) was also observed. The findings suggest that low pH and high HVED effective time are necessary to achieve high yields, while simultaneous effects of high pH value and prolonged HVED effective time is deleterious for the flavan-3-ols. This may be attributed to chemical reactions that occur during HVED treatment and that lead to reactive species production, including the ozone decomposition. These reactions are faster at high pH, while

a low pH, ozone is fairly stable. Such a hypothesis would explain the effectiveness of the process as an integration of the combined effect of HVED treatment and pH effect.

Quercetin-3-glucuronide, the major flavonol compounds of the raw material, is positively extracted at high pH value of 8.5. This higher pH value could increase the polarity of polyphenols by enhancing the dissociation of the mainly acidic phenolic –OH groups and subsequently promote the solubility of the molecule. It could also be hypothesis that the flavonols can be linked to cell wall components (polysaccharides, lignin). Because of the nature of the ester linkages, these compounds can be solubilized in alkaline conditions. For each compounds, the combination of low pH with long HVED treatment always lead to a better recovery of the molecules. In plus of enhancement of mass transfer and limitation of oxidizing species induced by HVED at low pH, the 2 combined factors may have a positive impact on hydrolysis mechanism. However, at high pH, long treatment time led systematically to a decrease of the flavonol considered, except for quercetin aglycon. There's a maximum HVED treatment time that lead to an optimal recovery of glycosylate quercetins. Above this time, these compounds seem to be degradated by the process. The aglycon form, that exhibited a different behaviour, systematically increases with HVED treatment whatever the pH. Consequently, it strongly suggested that the increase of aglycon quercetin may not only be due to the enhancement of mass transfer involved by the process. It may also be attributed to deglycosylation phenomena of the conjugate forms during HVED treatment, and particularly at high pH value. In most cases, prolonged extraction time at high pH may expose the phenolic compounds to oxidative degradation. This phenomenon is increase by HVED process.

In summary, the evidences from this study suggest that HVED is an efficient process to increase the recovery of individual flavan-3-ols and flavonols from grape stems wastes. However, the efficiency of HVED process regarding the enhancement of mass transfer is a function of the processing parameters. The HVED treatment time could impact the structure of the molecules and probably induced the degradation of polymeric compounds to monomeric compounds as well as deglycosylation phenomena. Finally, direct correlations between the extraction parameters (pH, HVED treatment and EtOH) imply that the different set of conditions might be of value to produce extracts with different biochemical characteristics and/or enriched in particular molecules.

Important point of discussion during the meeting:

M. Turk: This is a new study taking into consideration HVED treatment on the chemical composition. There would be a great interest to publish these data. S. Brianceau: For the same condition for pH and ethanol, HVED can increase polyphenol extraction by 2. M. Turk: 200 euros is the price for 1g of stilben. R. Ghidossi: It would be interesting to publish or protect this info for the consortium. M. Turk: HVED leads to high oxidation of polyphenols, but plays a major role in the stabilization of these molecules. S. Brianceau: Temperature during the extraction is under control at 20C.

11.30: Presentation of UBS – "Extraction by subcritical water and Purification of extracts by membrane processes: Work progress." – Sami Yammine

Title: *Extraction by subcritical water and Purification of extracts by membrane processes.*

Subcritcal water extraction

a) ***Objectives:*** *The general aim of the experiment is to define the best parameters for subcritical water extraction (SWE). More specifically, the extraction of polyphenols from the white grape marc Chardonnay and red marc merlot varieties at different temperatures.*

b) ***Method:*** *In each run pomace (13.00 g) was loaded into the high-pressure vessel. The vessel was placed in an oven at a predetermined temperature. The outlet valve of extraction vessel was then closed and the system was pressurized to a desired pressure at a constant flow rate.*

The water flow rate was adjusted at 6 ml/min using a metering valve on the HPLC pump. The solution collected in an inerted sampling vessel and pomace were then stored at 4 °C for further analysis.

Conventional extraction procedure: Polyphenols and flavonoids were conventionally extracted using common conditions used in UTC. Briefly, 20 g of pomace was added to 50 ml of pure ethanol and 50 ml of milli-Q water in 125 ml bottles with screw caps and placed on magnetic shaker. The extraction was taken place for 7 h, 20 °C at 160 rpm. The liquid was separated from solid by centrifugation at 5000 rpm for 10 min. The yield of this conventional method is used as the benchmark to evaluate the efficiency of subcritical water extraction. Samples were kept at 4°C for further analysis.

Then concentrations of total phenolic compounds (TP) were measured using Folin–Ciocalteu assay. Colouring Intensity (CI) and Total Polyphenol Index (TPI) were calculated according to handbook of oenology.

c) ***Results:***

Quantification of polyphenols from subcritical water extracts showed that higher the extraction temperature, more polyphenols are extracted, in both merlot and chardonnay varieties.

Several analytical tests such as Folin-Ciocalteau test and total polyphenol index, showed that there is a higher polyphenol extraction from Dunkelfelder varieties in comparison to Cabernet Franc, Merlot and Chardonnay respectively.

Purification of the extracts by membrane processes

a) ***Objectives:***

*The present work is devoted to the separation of polyphenols, extracted from Optimum PEF and SWEX grape pomace extracts. Separation was per-formed in two steps: (I) Filtration on filter sheets (0.35*μm*), and (II) Ultrafiltration of supernatants through cross flow filtration.*

b) ***Method:***

*Filtration on filter sheets (0.35*μm*) was carried out on Laffort L60 depth filter sheets made up of pure, diatomaceous and perlites for the filtration of wines. Filtration of the supernatants was carried out in the SEPA CF II filtration system equipped with a Hydracell diaphragm pump, a Baldor electric motor with a frequency variator capable of achieving different motor speeds and pump flows, with an effective area of 0.015 m2. The hydrophilic polyethersulfone ultrafiltration membrane (Microdyn-Nadir GmbH, Germany) with nominal molecular weight cut-offs (MWCO) of 30kDa and 3kDa was used for filtration. New membrane was used for every filtration test. Prior to filtration, the membranes were washed by distilled water, and then filtration of supernatant was started. After the filtration, the permeate and retentate were stored at 4 °C for further analysis.*

c) ***Results:***

Total polyphenol content was decreased by 26% at 30kDa and by 38% at 3 kDa in the permeate and while inversely the amount of polyphenols increased in the retentate.

PEF Showed filtered extracts with higher quercetin content while due to ethanol content SWEX filtered extracts showed content in anthocyanin more specifically Malvidine-3-O-glucosides.

d) ***Conclusion and perspectives:***

- *The optimum extraction in terms of operating parameters yields depends on the matrix.*
- *Dunkelfelder and chardonnay varieties seem to be a good matrix of extraction*
- *↗ temperature ↗ extraction of tannins et ↘ extraction of anthocyanin*
- *Optimization of the extraction barrels / copeaux matrix should be done in the following six month*
- *Optimization of filtration should be further refined [cut off, Pressure influence, temperature, membrane composition]*

Important point of discussion during the meeting:

E. Vorobiev: Have you tried to use any solvent during sub-critical water extraction S. Yammine: there are several works that have published subcritical solvent extraction but we have not tried it. E. Vorobiev: It might be interesting and innovative to combine PEF to SWEX for further studies.

Main actions for the next Campaign

EIC:

Wine shoots were proposed, but all depends on the further study of the partners. Further analysis and the study of the storage will be continued.

UTC:

For the next campaign, UTC/ESCOM will prepare extracts for control and PEF treated Oak ships. The parameters, which will be uses, are the optimal conditions identified at the laboratory scale. The extracts as well as the phenolic profiles of the extracts should be prepared and sent before the next meeting in GEI.

UBS and UTC should have more discussion about the reference methods for polyphenols extraction. The reflection should include all the selected raw materials.

UBS:

Idem as UTC regarding extracts preparation. The quantites of extracts needed for the experiments will be prepared.

A small report will be prepared about the interesting compounds in the different types of raw materials.

Optimization of filtration should be further refined in order to send a specific number of extracts to GEI.

GEI:

The partner GEI will carry on comparison experiments using the extracts and oenological tannins that will be prepared by UTC and UBS partners. Several types of extracts will be provided for this study Dunkelfelder red grape pomaces and Chardonnay extracts. For each type of raw material, PEF and SWE treatments will be applied and control extracts will also be prepared.